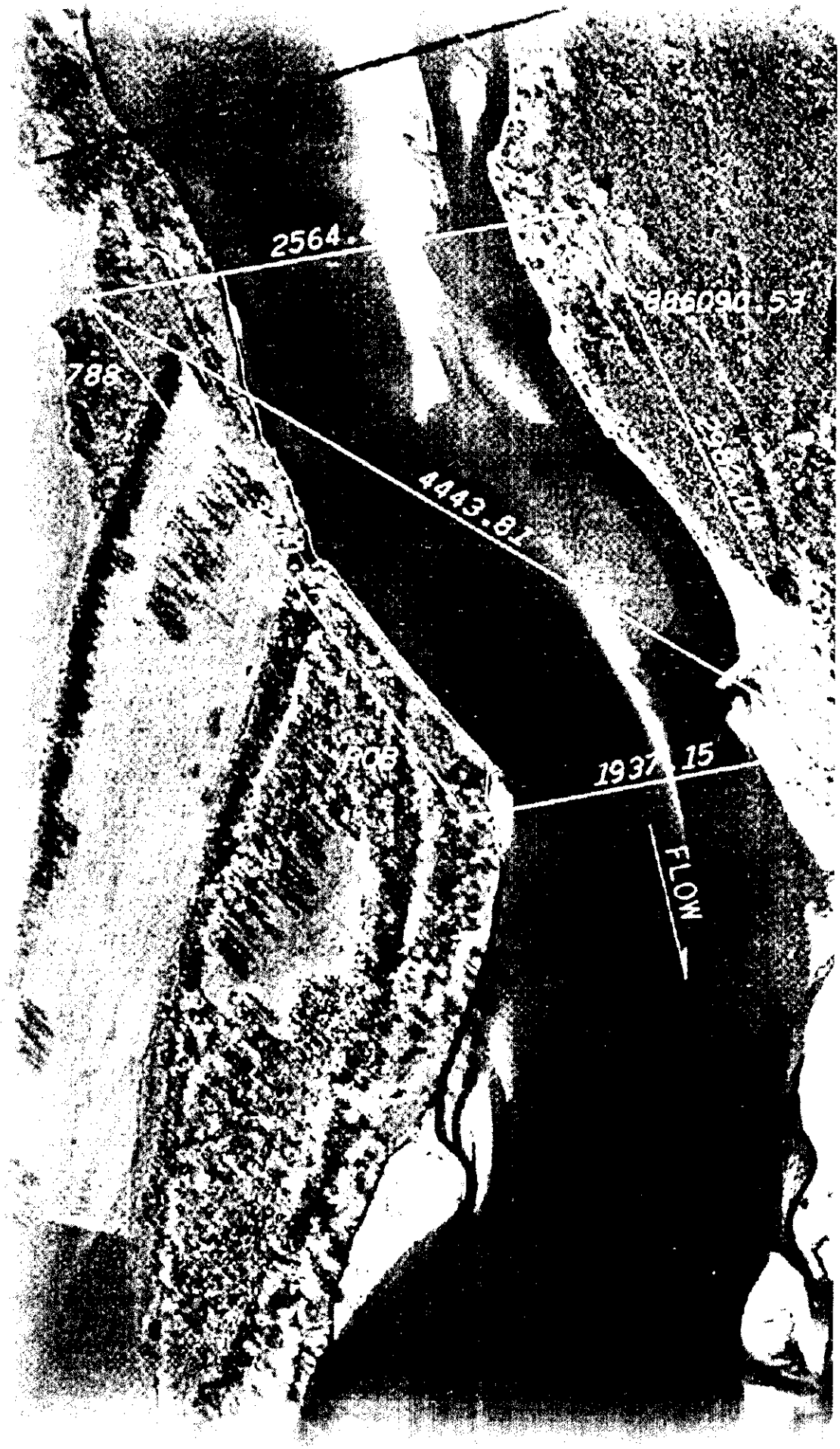


Missouri River Streambank Erosion Assessment

Gavins Point Dam to Ponca, NE

U. S. Army Corps of Engineers
Omaha District

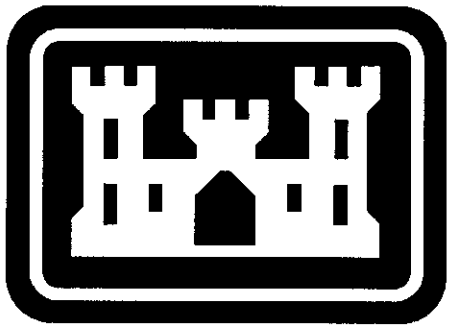
Contract No.
DACW45-97-D-0007

Delivery Order 0019

April 1999

HDR Engineering, Inc.

Missouri River Streambank Erosion Assessment
Gavins Point Dam to Ponca, NE



Prepared for:

U.S. Army Corps of Engineers
Omaha District
Omaha, Nebraska

Contract No. DACW45-97-D-0007
(Delivery Order 0019)

HDR

Prepared by:

HDR Engineering, Inc.
Omaha, Nebraska

April 1999

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1.0 PURPOSE

The purpose of this report is to document the methodology and results obtained from a study of bank erosion along the Missouri River between Gavins Point Dam (RM 805.2) and Ponca, Nebraska (RM 752.3). Three (3) periods were studied: 1) August 1985 to August 1995, a time span of 10 years and; 2) from August 1995 and August 1997, a time span of 2 years. This study has been prepared by HDR Engineering, Inc. (HDR) under Contract No. DACW45-97-D-0007 (Delivery Order 0019) for the Omaha District of the U.S. Army Corps of Engineers.

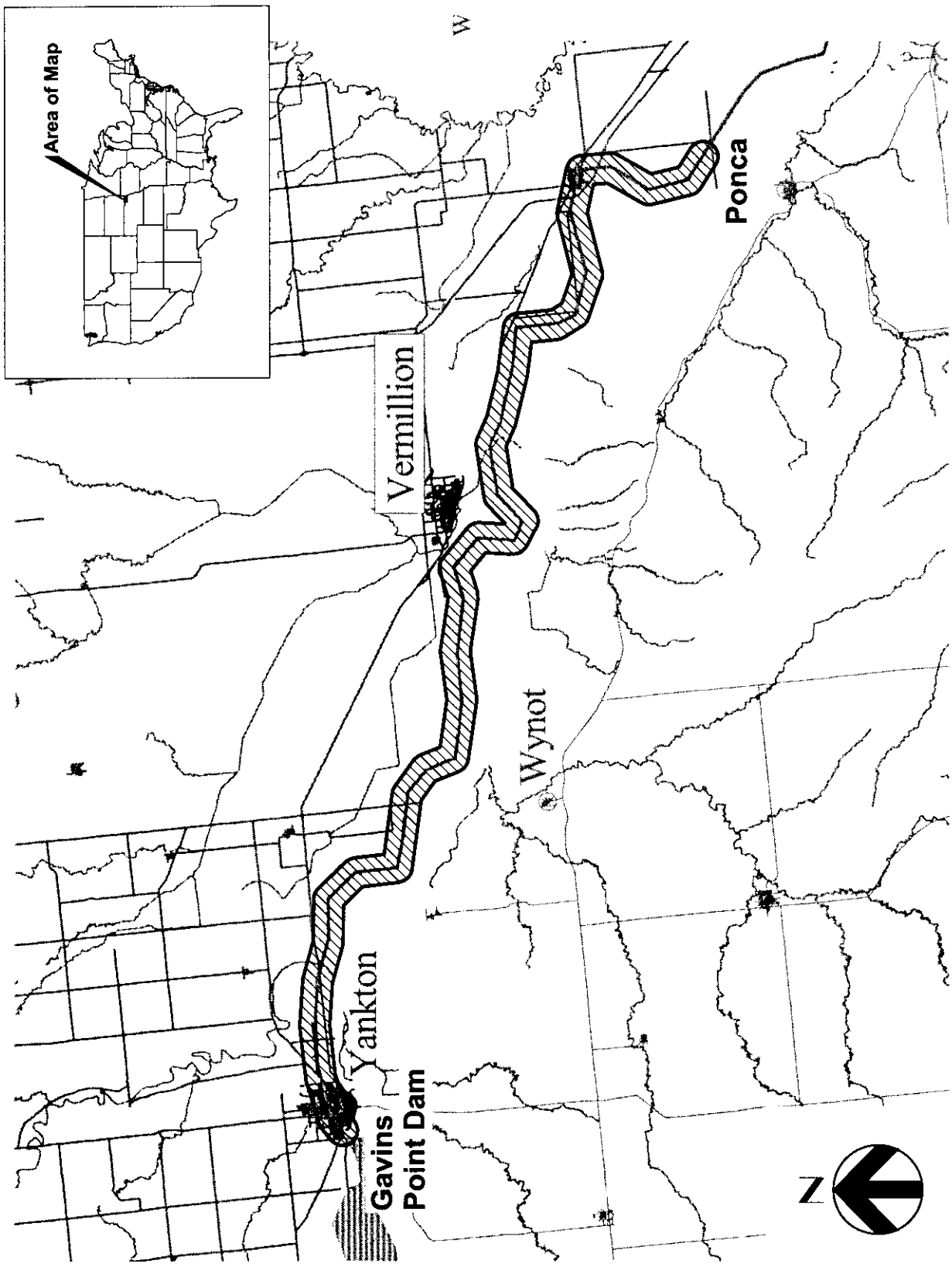
2.0 STUDY OBJECTIVES

The specific objective of this study is to up-date bank erosion estimates for the Gavins Point Dam to Ponca State Park, NE reach of the Missouri River (Figure 1), a distance of approximately 52.9 miles, using aerial photography obtained in August 1985, August 1995 and August 1997. As discussed in the Scope of Work furnished by the Omaha District, bank erosion is defined as the aerial surface loss (in acres) of potentially useable or productive land.

3.0 EVALUATION PROCEDURE

Aerial photographic coverage of the Missouri River for 1985, 1995 and 1997 was used to divide the study reach into segments whose lengths are dictated by the coverage possible on individual photographs. The central area of the individual photographs was utilized to the extent possible to limit the amount of distortion. Segment points for the three (1985, 1995 and 1997) sets of aerial photographs were established by selecting identifiable objects or intersecting linear features such as structures, fence corners, road or field intersections, individual trees or small tree clumps.

These objects were used for the identifiable points from which the segments were established. The points were selected as near to the water's edge as possible, but not so close that the point could be lost to erosion during the foreseeable future. The points were also located such that both banklines lie entirely within the segments, when possible. The



HDR

HDR Engineering, Inc.

Location Map
Gavins Point Dam to Ponca, Nebraska

Streambank Erosion Assessment - Missouri River
U. S. Army Corps of Engineers
Omaha District

Date
Apr. 1999

Figure
1

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points for each segment were then connected by lines to form an irregular quadrilateral which defines the boundaries of the river segment. The segments were further subdivided into two triangles on both sets of photographs and as discussed in Section 3.2 scale and photographic distortion correction factors were calculated. Figure 2 represents a generalized segment.

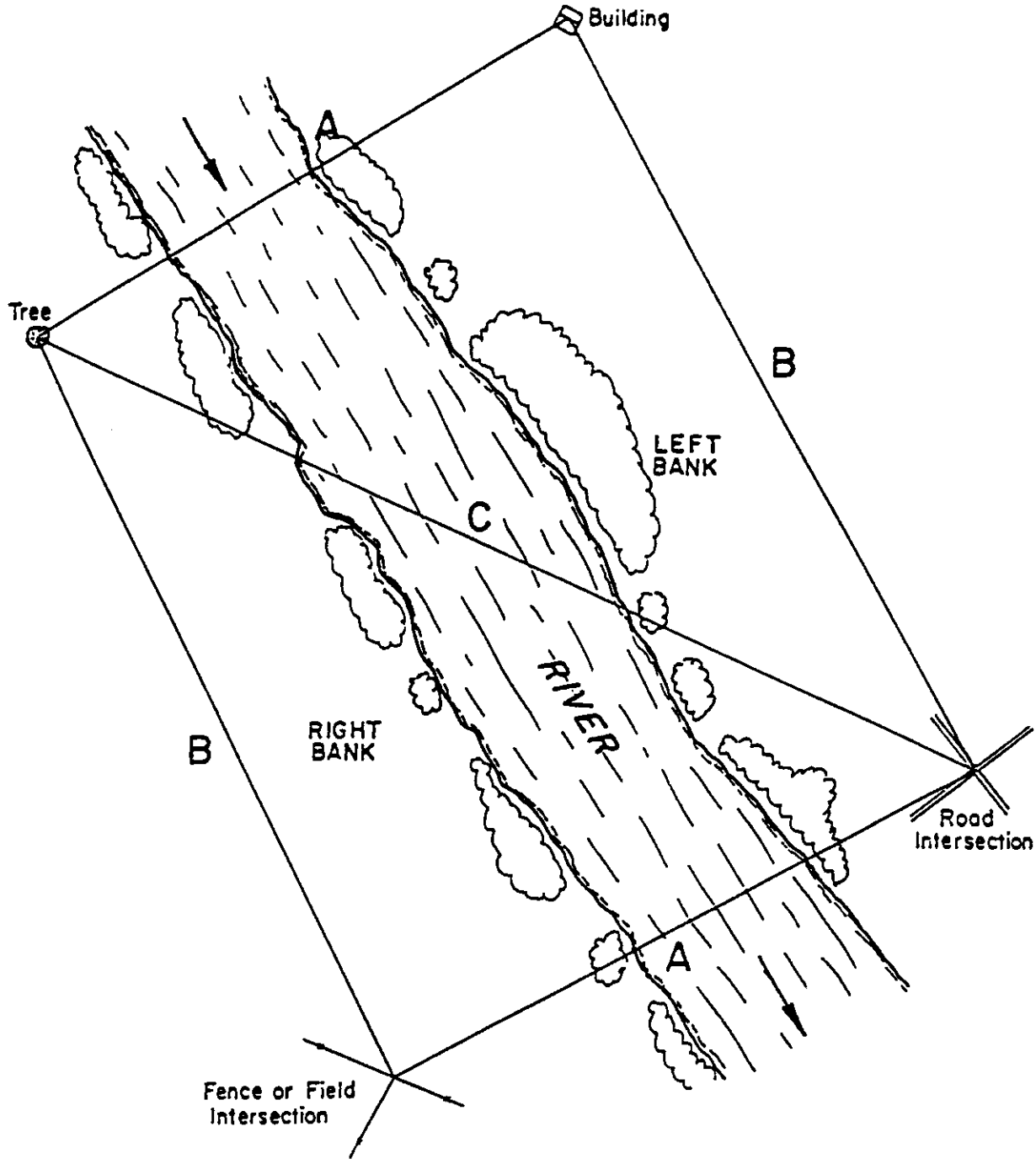
Streambank erosion values were derived by measuring, individually, on each set of photographs, the left and right bank areas in each segment as defined by the surface area between the outside segment boundary lines and the river bank. An area correction factor was used to adjust the measured bankline areas. This corrected bankline area change in bankline areas between the same river segments for the 1985, 1995 and 1997 photograph sets reflect the amount of erosion or accretion in these areas.

3.1 Electronic Process

In past studies, the segment was drawn directly on the aerial or an acetate overlay and the length and bankline area measurements obtained. For this study, an electronic process was developed to obtain the segment length and bankline area measurements. This process included scanning the aerials, attaching the image, identifying the segment points, creating the quadrilateral, tracing the banklines, measuring the segment lengths and bankline areas and extracting the data. The following paragraphs describe the process in detail.

3.1.1 Scanning Process

The 9" x 9" aerial photography for 1985 and 1995 were scanned at a gray scale using a HP Scanjet scanner. The 1985 aerials were at a scale of 1" = 2,000' and scanned at 300 dpi, while the 1995 aerials were at a scale of 1" = 1,000' and scanned at 200 dpi. Due to the scanning window, an 8-1/2" by 9" tiff (tif) imagery was created. Once the images were stored, a batch conversion process was used to generate .hmr files. This process compressed the file size by making the images manageable and generated world files used to locate the images (by coordinates and pixel size) to a border sheet within MicroStation SE using Image Manager. This process provided consistency in image size and location on the drawing. The .hmr file also ensured that the image would be attached



HDR Engineering, Inc.

Generalized Diagram for Quadrilateral Segments

Streambank Erosion Assessment - Missouri River
U. S. Army Corps of Engineers
Omaha District

Date: Apr. 1999

Figure: 2

Quad Diagram.cdr
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9-2-98

at the proper scale and provided actual scaled measurements of the segment.

The 1997 ortho-corrected aerials were obtained from the USACE, Omaha District in a .tif format. Because the aerials were already in a digital format, the 9" x 9" aerials were not scanned.

3.1.2 Attaching the Imagery

In some instances, the segment was defined on multiple aerials. Segments covering multiple aerials were merged with HMR Descartes or Corel Photo Paint 8.0, two image manipulation software packages. The images were attached at the same scale in HMR Descartes. The overlapping areas of the images were noted and obvious physical features contained in the overlapping portions of the images were traced with vector elements. The adjoining/overlapping image was then moved and rotated to closely match the vectors. Careful consideration was given to the inherent distortion of the photo near the edge of the images. In an effort to reduce image elongation and exaggeration, and accompanying error, the images were matched as close as possible to the vector elements nearing the center of the images. Once the images were located correctly, the images were merged using the corridor tool within HMR Descartes. Imagery was not warped or adjusted in any way in this process; therefore, the accuracy of the resultant data was not compromised.

The 1995 aerials were tiled together to form a mosaic with HMR Descartes. Typically 2 flight paths were flown to capture the river and its overbanks; thereby, a segment was defined on multiple aerials. Each image was saved as a read only format and then saved as a composite image consisting of several segments. This composite image or corridor contained several segments with overlapping segments at the end. The 1995 reach was defined by 5 sub-reaches or corridors. Imagery was not warped or adjusted in any way in this process; therefore, the accuracy of the resultant data was not compromised.

The 1997 ortho-corrected aerial was converted from a .tif format to a .hmr format as well as reduced from color to gray scale. This reduced the file size and made working with the

images manageable. The images were loaded into MicroStation using HMR Descartes. The 1997 reach was defined by 3 sub-reaches or projects.

3.1.3 Measurements and Data Extraction

Length and area measurements were accomplished using MicroStation commands. An in-house macro was developed to step through the process and export relevant data to a text file. After determining the identifying objects on the 1985 aerials, the four points were selected to form a quadrilateral beginning at the upstream right overbank and continuing in a clockwise direction. The right and left banklines were traced on the scanned image representing the usable lands. After the length measurements are annotated and the banklines traced, the upstream and downstream segment lines were manually trimmed to create a stand alone polygon. A macro then calculated the enclosed bankline areas using the calculate area by flood command. The left bank area then the right bank area was generated and annotated. The macro then generated a diagonal line extending from the upstream right overbank point to the downstream left overbank point and annotated the diagonal. The length and area measurements were exported into a comma delimited text file (.csv). A sample of the data string follows:

Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Field 7	Field 8
gp95001	4575	7021	3503	6478	7349	9358838	5421626

Field 1 is the file name, Fields 2-5 are the quadrilateral lengths, in feet, beginning at the upstream right overbank and continuing in a clockwise direction. Field 6 is the diagonal length and fields 7 and 8 contain the computed left and right bank areas in square feet, respectively. The data in the .csv file and the plotted drawing were compared and the data modified as necessary.

3.1.4 Verification Process

The electronic process has been verified on the Garrison, Fort Peck and Fort Randall Reaches. Test segments were not conducted for the Gavins Point Reach since the electronic process was verified in previous studies.

3.2 Distortion and Scale Factors

The procedures used to develop the factors necessary to correct for scale and photographic distortion were derived during an aerial assessment of streambank erosion and were used for this study. The procedures used, including the steps necessary to correct for scale and photographic distortion for this study, are described below.

3.2.1 Scale Correction Factors

Segment boundaries were defined by connecting the same four points based on identifiable objects on each set of photos to form an irregular quadrilateral which encompassed the river. The upstream and downstream boundaries were designated as the upstream and downstream segment cross-sections, respectively. The remaining two boundary sides were designated as the segment sides.

Scale correction factors between photographs of the 1985, 1995 and 1997 photograph sets were derived as follows:

a. The length of the upstream and downstream cross-sections of each segment was measured from end to end.

b. Starting at the upstream end of the study reach and progressing downstream, the length of the downstream cross-section of the first or previous segment was divided by the length of the upstream cross-section of the next downstream segment (same cross-section for two consecutive segments). This provides a correlation (Photo Scale Factor) between photographs of the same set where the segments are on separate photos. The Photo Scale Factor for segment 1 was assumed to be 1.00. Where consecutive segments were located on the same photograph, the Photo Scale Factor for the downstream segment was also set equal to 1.0.

c. The Photo Scale Factor (PSF) for the desired segment of interest was multiplied by the Photo Scale Factor for the previous (next upstream)

segment. The product was then squared to derive the Segment Scale Correction Factor (SSCF). Segment Scale Correction Factors for the 1997 photos were not required since 1985 is used as the base year for the 1985/1995 assessment and 1995 is used as the base year for the 1995/1997 assessment.

The equations used to compute the Photo Scale and Segment Scale Correction Factors are presented below in generalized form:

Photo Scale Factor (PSF)

$$PSF\ for\ Segment\ X = \frac{D/S\ X - Section\ \ (Segment\ X - 1)}{U/S\ X - Section\ (Segment\ X)}$$

where: PSF = Photo Scale Factor

X = Segment Number for which the PSF is desired

Segment Scale Correction Factor (SSCF)

$$SSCF\ for\ Segment\ X = \left[(PSF\ for\ Segment\ X - 1)(PSF\ for\ Segment\ X)\right]^2$$

where: SSCF = Segment Scale Correction Factor

PSF = Photo Scale Factor

X = Segment Number for which the SSCF is desired

The Photo Scale Factors and Segment Scale Correction Factors derived for the 1985 and 1995 photograph sets are presented in Tables 1 and 2, respectively. A sample computation showing derivation of a Segment Scale Correction Factor used in this study is shown at the end of Tables 1 and 2.

3.2.2 Distortion and Area Correction Factors

To correct for distortion, each quadrilateral segment on the three-(3) sets of photos (1985, 1995 and 1997) was divided into two triangles. Connecting a diagonal line from the right bank point of the upstream cross-section to the left bank point on the downstream cross-

section created the triangles, where right and left are defined relative to a view in the downstream direction. Distortion and area correction factors were computed as follows:

a. All sides of both triangles for each segment were measured for all sets of aerial photographs (Tables 3, 4 and 5). The area was computed for each triangle using the following equations:

$$S = \frac{A + B + C}{2}$$

$$\text{Triangle Area} = [S(S - A)(S - B)(S - C)]^{1/2}$$

where: S = Segment triangle side
A = Upstream or downstream side of the triangle
B = Right or left overbank side the triangle
C = Diagonal length of the triangle

b. The areas of both triangles for each segment were added to get the total area of each segment for the three (3) sets of photos (Tables 6, 7, and 8).

c. The Distortion Correction Factor (DCF) for the 1995 photo set was determined by dividing the 1985 segment area by the corresponding 1995 segment area (Table 9) for the 1985/1995 assessment. The Distortion Correction Factor for the 1985 photo series equaled 1.00 for the 1985/1995 assessment since 1985 was selected as the base year. The DCF for the 1997 photo set was determined by dividing the 1995 segment area by the corresponding 1997 segment area (Table 10) for the 1995/1997 assessment. The DCF for the 1995 photo series equaled 1.00 for the 1995/1997 assessment since 1995 was selected as the base year.

d. The Area Correction Factor (ACF) for each segment on the three (3) sets of photos was then determined by multiplying the Distortion Correction

Factors for each set of photos by the appropriate 1985, 1995 and 1997 Segment Scale Correction Factor (Tables 9 and 10).

3.2.3 Changes in Bankline Area

Segment bankline areas for the 1985, 1995 and 1997 photographs were derived by measuring the area bounded by the upstream and downstream cross-section lines, the river bankline and the right or left segment sides. The measured areas were then multiplied by the appropriate Area Correction Factor to obtain the corrected areas. Measured and corrected left and right bank areas are tabulated separately for the 1985, 1995 and 1997 photos sets in Tables 11 through 14.

The 1995 corrected bankline areas were subtracted from the 1985 corrected bankline areas to determine the differences in area from August 1985 to August 1995. The 1997 corrected bankline areas were subtracted from the 1995 corrected bankline areas to determine the difference in area from August 1995 to August 1997. The difference between the corrected bankline areas was converted to acres by dividing the area difference in square feet by 43,560. Decreases in bankline areas for this period are shown in Tables 15 and 16. Increases or accretion in bankline areas are reported as no erosion loss.

4.0 SEGMENT CROSS-SECTION LOCATIONS AND BANKLINE LENGTHS

Segment cross-sections were based on the photo mosaic maps of the Missouri River using the points based on objects from the study aerial photographs. River mile location of each segment cross-section was determined by the intersection of the cross-section with a straight line drawn between river mile markers and proportioning the intersection between the upstream and downstream river mile marker. River mile locations for each segment cross-section are presented in Table 17.

Also shown in Table 17 are approximate bankline lengths in miles as used in determining erosion rates. The river mile location of each segment cross-section was determined by subtracting the river mile stations. Measured bankline lengths were not used in the erosion estimates; therefore, the bankline length may be shorter or longer.

5.0 EROSION RATES

Bankline area differences from Table 15 and river mile locations from Table 17 were used to determine the erosion rates for each segment for the 10-year period from August 1985 to August 1995. Erosion loss and erosion rates for the left and right banks are presented in Tables 18 and 19, respectively.

Bankline area differences from Table 16 and river mile locations from Table 17 were used to determine the erosion rates for each segment for the 2-year period from August 1995 to August 1997. Erosion loss and erosion rates for the left and right banks are presented in Tables 20 and 21, respectively.

6.0 DISCUSSION

The segment boundaries defined on the 1985 aerials were used as a guide to locate the segment points. It was found that the segment points were drawn too close to the overbanks; therefore, new segment points were defined. Whenever possible, hard points or objects (i.e. buildings or road intersections) were used to define the segments.

Much of the 1995 aerial photo set was flown such that the river channel is located along one of the margins of the photograph. Many of the segments were irregular in shape and may be somewhat distorted due to segment location towards the edges of the photos.

Using ortho-corrected aerial imagery provides more accurate results because the photographic distortion and scale are greatly reduced. Due to the large file size, an ortho-corrected image file can become cumbersome and unmanageable. Further compression of the imagery using commercial software can reduce the file size.

Table 1. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE Photo Scale Factors (PSF) and Segment Scale Correction Factors (SSCF) for 1985 Aerial Photography. (1)

Segment No.	Cross-Section Length (in.) Upstream	Downstream	Photo Scale Factor (PSF) (1)	Segment Scale Correction Factor (SSCF)(4)
1	4,376	3,406	1.000	1.000
2	3,411	6,193	0.998	0.997
3	6,191	5,547	1.000	0.998
4	5,547	5,098	1.000	1.001
5	5,109	10,868	0.998	0.996
6	10,874	9,440	0.999	0.994
7	9,445	6,226	0.999	0.998
8	6,206	4,112	1.003	1.005
9	4,120	5,897	0.998	1.002
10	5,973	5,915	0.987	0.971
11	5,924	4,213	0.998	0.972
12	4,250	4,410	0.991	0.980
13	4,379	5,451	1.007	0.997
14	5,414	6,551	1.007	1.028
15	6,572	6,446	0.997	1.007
16	6,516	2,371	0.989	0.972
17	2,335	4,249	1.015	1.009
18	4,249	5,322	1.000	1.031
19	5,336	6,808	0.997	0.995
20	6,781	6,143	1.004	1.003
21	6,207	4,847	0.990	0.988
22	4,830	7,632	1.003	0.986
23	7,620	6,955	1.002	1.010
24	6,786	6,804	1.025	1.054
25	6,891	5,791	0.987	1.024
26	5,781	5,715	1.002	0.978
27	5,715	8,170	1.000	1.004
28	8,159	5,053	1.001	1.003
29	5,053	6,757	1.000	1.003
30	6,611	8,563	1.022	1.045
31	8,563	6,281	1.000	1.045
32	6,319	6,935	0.994	0.988
33	6,935	9,113	1.000	0.988
34	9,102	8,333	1.001	1.002
35	8,333	5,921	1.000	1.002
36	5,933	7,012	0.998	0.996
37	7,006	8,088	1.001	0.998
38	8,041	5,105	1.006	1.013
39	5,105	4,638	1.000	1.012
40	4,657	3,122	0.996	0.992
41	3,042	7,097	1.026	1.045
42	7,097	5,774	1.000	1.053
43	5,882	7,234	0.982	0.964

Table 1. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE Photo Scale Factors (PSF) and Segment Scale Correction Factors (SSCF) for 1985 Aerial Photography. (1)

Segment No.	Cross-Section Length (in.) Upstream	Downstream	Photo Scale Factor (PSF) (1)	Segment Scale Correction Factor (SSCF)(4)
44	7,243	8,493	0.999	0.961
45	8,440	8,015	1.006	1.010
46	8,015	5,236	1.000	1.013
47	5,236	4,769	1.000	1.000
48	4,759	5,655	1.002	1.004
49	5,655	4,506	1.000	1.004
50	4,497	2,635	1.002	1.004

(1) Segment No. 1 - PSF and SSCF assumed to be 1.0

$$\text{PSF (seg X)} = \frac{\text{Downstream X-section length (Seg X-1)}}{\text{Upstream X-section length (Seg X)}}$$

(2) $\text{SSCF (seg X)} = [(\text{PSF Segment X-1}) * (\text{PSF Segment X})]^{2}$

Table 2. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE Photo Scale Factors (PSF) and Segment Scale Correction Factors (SSCF) for 1995 Aerial Photography.

Segment No.	Cross-Section Length (ft.) Upstream	Downstream	Photo Scale Factor (PSF) (1)	Segment Scale Correction Factor (SSCF)(2)
1	4,575	3,503	1.000	1.000
2	3,503	6,458	1.000	1.000
3	6,458	5,869	1.000	1.000
4	5,869	5,141	1.000	1.000
5	5,141	11,207	1.000	1.000
6	11,207	9,722	1.000	1.000
7	9,722	6,309	1.000	1.000
8	6,309	4,364	1.000	1.000
9	4,364	5,891	1.000	1.000
10	5,891	6,004	1.000	1.000
11	6,004	4,271	1.000	1.000
12	4,271	4,438	1.000	1.000
13	4,438	5,369	1.000	1.000
14	5,369	6,519	1.000	1.000
15	6,519	6,686	1.000	1.000
16	6,686	2,561	1.000	1.000
17	2,561	4,263	1.000	1.000
18	4,263	5,199	1.000	1.000
19	5,199	6,663	1.000	1.000
20	6,663	5,967	1.000	1.000
21	5,967	4,830	1.000	1.000
22	4,830	7,437	1.000	1.000
23	7,437	6,810	1.000	1.000
24	6,810	6,813	1.000	1.000
25	6,813	5,608	1.000	1.000
26	5,608	5,905	1.000	1.000
27	5,905	8,207	1.000	1.000
28	8,207	4,970	1.000	1.000
29	4,970	6,651	1.000	1.000
30	6,651	8,781	1.000	1.000
31	8,781	6,521	1.000	1.000
32	6,521	6,987	1.000	1.000
33	6,987	9,076	1.000	1.000
34	9,076	8,198	1.000	1.000
35	8,198	5,927	1.000	1.000
36	5,927	6,874	1.000	1.000
37	6,874	7,861	1.000	1.000
38	7,861	5,028	1.000	1.000
39	5,028	4,510	1.000	1.000
40	4,510	3,040	1.000	1.000
41	3,040	6,941	1.000	1.000
42	6,941	5,843	1.000	1.000
43	5,843	7,133	1.000	1.000

Table 2. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE Photo Scale Factors (PSF) and Segment Scale Correction Factors (SSCF) for 1995 Aerial Photography.

Segment No.	Cross-Section Length (ft.) Upstream	Downstream	Photo Scale Factor (PSF) (1)	Segment Scale Correction Factor (SSCF)(2)
44	7,133	8,094	1.000	1.000
45	8,094	8,015	1.000	1.000
46	8,015	5,214	1.000	1.000
47	5,214	4,703	1.000	1.000
48	4,703	5,698	1.000	1.000
49	5,698	4,402	1.000	1.000
50	4,402	2,731	1.000	1.000

(1) Segment No. 1 - PSF and SSCF assumed to be 1.0

$$\text{PSF (seg X)} = \frac{\text{Downstream X-section length (Seg X-1)}}{\text{Upstream X-section length (Seg X)}}$$

(2) $\text{SSCF (seg X)} = [(\text{PSF Segment X-1}) * (\text{PSF Segment X})]^2$

Table 3. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE
Side Lengths of Segments Triangles for 1985 Aerial Photography.

1985 Triangle Lengths (feet)

Segment No.	Left Bank*			Right Bank*		
	Upstream X-Section (A)	Left Side (B)	Diagonal Side (C)	Downstream X-Section (A)	Right Side (B)	Diagonal Side (C)
1	4,376	6,568	7,074	3,406	6,236	7,074
2	3,411	7,750	8,739	6,193	7,847	8,739
3	6,191	2,885	6,963	5,547	5,269	6,963
4	5,547	7,254	9,287	5,098	6,150	9,287
5	5,109	7,852	9,667	10,868	6,263	9,667
6	10,874	2,949	10,057	9,440	4,121	10,057
7	9,445	4,107	9,592	6,226	5,750	9,592
8	6,206	6,800	6,079	4,112	5,817	6,079
9	4,120	7,019	6,432	5,897	3,546	6,432
10	5,973	8,588	6,297	5,915	8,098	6,297
11	5,924	6,028	7,218	4,213	8,680	7,218
12	4,250	6,412	7,966	4,410	5,608	7,966
13	4,379	3,961	6,436	5,451	3,461	6,436
14	5,414	7,417	8,542	6,551	4,215	8,542
15	6,572	8,080	9,651	6,446	6,913	9,651
16	6,516	2,072	7,245	2,371	5,911	7,245
17	2,335	3,601	5,474	4,249	4,493	5,474
18	4,249	5,286	7,049	5,322	5,877	7,049
19	5,336	4,035	7,485	6,808	3,385	7,485
20	6,781	5,399	8,597	6,143	5,121	8,597
21	6,207	7,099	8,122	4,847	6,881	8,122
22	4,830	7,984	10,537	7,632	7,302	10,537
23	7,620	3,662	8,491	6,955	4,344	8,491
24	6,786	7,609	7,714	6,804	1,015	7,714
25	6,891	5,677	7,167	5,791	3,742	7,167
26	5,781	2,567	5,912	5,715	2,353	5,912
27	5,715	1,086	6,614	8,170	6,974	6,614
28	8,159	2,220	6,473	5,053	6,703	6,473
29	5,053	3,037	6,036	6,757	5,410	6,036
30	6,611	5,635	8,883	8,563	673	8,883
31	8,563	6,110	8,134	6,281	2,270	8,134
32	6,319	4,364	8,503	6,935	2,178	8,503
33	6,935	6,198	11,944	9,113	7,040	11,944
34	9,102	4,492	9,064	8,333	3,537	9,064
35	8,333	4,002	8,389	5,921	5,414	8,389
36	5,933	6,892	10,336	7,012	7,077	10,336
37	7,006	10,689	8,236	8,088	2,533	8,236
38	8,041	3,747	7,442	5,105	5,437	7,442
39	5,105	3,573	6,194	4,638	3,682	6,194
40	4,657	1,343	4,272	3,122	4,746	4,272
41	3,042	8,349	9,679	7,097	5,895	9,679
42	7,097	3,252	8,590	5,774	6,160	8,590

Table 3. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE
Side Lengths of Segments Triangles for 1985 Aerial Photography.

1985 Triangle Lengths (feet)

Segment No.	Left Bank*			Right Bank*		
	Upstream X-Section (A)	Left Side (B)	Diagonal Side (C)	Downstream X-Section (A)	Right Side (B)	Diagonal Side (C)
43	5,882	4,011	8,103	7,234	2,559	8,103
44	7,243	6,381	10,197	8,493	5,317	10,197
45	8,440	11,042	9,255	8,015	1,838	9,255
46	8,015	6,131	6,874	5,236	2,260	6,874
47	5,236	3,621	5,468	4,769	4,745	5,468
48	4,759	5,411	7,408	5,655	5,021	7,408
49	5,655	2,536	7,467	4,506	5,530	7,467
50	4,497	3,483	5,933	2,635	5,088	5,933

* Right and left as viewed in a downstream direction.

Table 4. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE
Side Lengths of Segments Triangles for 1995 Aerial Photography.

1995 Triangle Lengths (feet)

Segment No.	Left Bank*			Right Bank*		
	Upstream X-Section (A)	Left Side (B)	Diagonal Side (C)	Downstream X-Section (A)	Right Side (B)	Diagonal Side (C)
1	4,575	7,021	7,349	3,503	6,478	7,349
2	3,503	7,793	8,834	6,458	7,724	8,834
3	6,458	2,845	7,215	5,869	5,545	7,215
4	5,869	7,408	9,737	5,141	6,505	9,737
5	5,141	7,931	9,778	11,207	6,333	9,778
6	11,207	2,984	10,342	9,722	4,185	10,342
7	9,722	4,138	9,811	6,309	5,818	9,811
8	6,309	6,861	6,236	4,364	5,931	6,236
9	4,364	6,987	6,426	5,891	3,677	6,426
10	5,891	8,296	6,021	6,004	8,043	6,021
11	6,004	5,836	7,042	4,271	8,328	7,042
12	4,271	6,426	8,165	4,438	5,561	8,165
13	4,438	3,822	6,481	5,369	3,464	6,481
14	5,369	7,262	8,460	6,519	4,083	8,460
15	6,519	7,832	9,633	6,686	6,739	9,633
16	6,686	2,049	7,427	2,561	5,911	7,427
17	2,561	3,757	5,903	4,263	4,791	5,903
18	4,263	5,050	6,865	5,199	5,911	6,865
19	5,199	4,020	7,360	6,663	3,376	7,360
20	6,663	5,338	8,512	5,967	5,194	8,512
21	5,967	6,891	7,876	4,830	6,428	7,876
22	4,830	7,706	10,416	7,437	7,217	10,416
23	7,437	3,354	8,031	6,810	3,641	8,031
24	6,810	7,297	7,792	6,813	1,078	7,792
25	6,813	5,461	6,982	5,608	3,846	6,982
26	5,608	2,596	5,863	5,905	2,223	5,863
27	5,905	925	6,584	8,207	6,560	6,584
28	8,207	2,297	6,498	4,970	6,753	6,498
29	4,970	3,134	6,146	6,651	5,399	6,146
30	6,651	5,683	9,062	8,781	618	9,062
31	8,781	6,083	8,380	6,521	2,309	8,380
32	6,521	4,346	8,700	6,987	2,651	8,700
33	6,987	6,173	11,988	9,076	7,081	11,988
34	9,076	4,363	9,081	8,198	3,472	9,081
35	8,198	3,521	8,319	5,927	5,466	8,319
36	5,927	6,758	10,220	6,874	7,019	10,220
37	6,874	10,258	7,922	7,861	2,524	7,922
38	7,861	3,698	7,268	5,028	5,366	7,268
39	5,028	3,637	6,145	4,510	3,710	6,145
40	4,510	1,283	4,159	3,040	4,765	4,159
41	3,040	8,195	9,298	6,941	5,624	9,298
42	6,941	3,161	8,355	5,843	5,892	8,355

Table 4. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE
Side Lengths of Segments Triangles for 1995 Aerial Photography.

1995 Triangle Lengths (feet)

Segment No.	Left Bank* Upstream X-Section (A)	Left Side (B)	Diagonal Side (C)	Right Bank* Downstream X-Section (A)	Right Side (B)	Diagonal Side (C)
43	5,843	3,945	7,974	7,133	2,538	7,974
44	7,133	6,285	9,944	8,094	5,056	9,944
45	8,094	10,582	9,225	8,015	1,786	9,225
46	8,015	6,211	6,746	5,214	2,223	6,746
47	5,214	3,537	5,416	4,703	4,692	5,416
48	4,703	5,434	7,325	5,698	4,961	7,325
49	5,698	2,538	7,489	4,402	5,517	7,489
50	4,402	3,289	5,744	2,731	4,821	5,744

* Right and left as viewed in a downstream direction.

Table 5. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE
Side Lengths of Segments Triangles for 1997 Aerial Photography.

1997 Triangle Lengths (feet)

Segment No.	Left Bank* Upstream X-Section (A)	Left Side (B)	Diagonal Side (C)	Right Bank* Downstream X-Section (A)	Right Side (B)	Diagonal Side (C)
1	4,498	6,775	7,272	3,548	6,474	7,272
2	3,548	7,925	8,917	6,399	7,998	8,917
3	6,399	3,036	7,150	5,663	5,497	7,150
4	5,663	7,575	9,649	5,356	6,355	9,649
5	5,356	8,120	10,006	11,469	6,639	10,006
6	11,469	3,028	10,657	9,792	4,263	10,657
7	9,792	4,197	9,910	6,423	5,902	9,910
8	6,423	7,067	6,341	4,348	6,096	6,341
9	4,348	7,107	6,552	6,083	3,636	6,552
10	6,083	8,917	6,484	6,072	8,454	6,484
11	6,072	6,263	7,346	4,333	8,760	7,346
12	4,333	6,639	8,319	4,533	5,892	8,319
13	4,533	4,005	6,631	5,806	3,719	6,631
14	5,806	7,797	8,740	7,022	4,200	8,740
15	7,022	8,285	10,067	6,635	6,992	10,067
16	6,635	2,141	7,394	2,449	5,920	7,394
17	2,449	3,748	5,758	4,246	4,767	5,758
18	4,246	5,414	7,133	5,504	6,052	7,133
19	5,504	4,127	7,672	6,958	3,497	7,672
20	6,958	5,459	8,815	6,316	5,218	8,815
21	6,316	7,240	8,368	4,764	7,062	8,368
22	4,764	8,010	10,559	7,807	7,428	10,559
23	7,807	3,786	8,661	7,075	4,417	8,661
24	7,075	7,870	8,151	7,159	1,126	8,151
25	7,159	5,897	7,380	5,987	3,821	7,380
26	5,987	2,750	6,351	6,076	2,414	6,351
27	6,076	858	6,748	8,407	7,174	6,748
28	8,407	2,408	6,582	5,118	6,832	6,582
29	5,118	3,224	6,259	6,913	5,543	6,259
30	6,913	5,846	9,260	8,947	684	9,260
31	8,947	6,328	8,516	6,438	2,576	8,516
32	6,438	4,542	8,660	7,155	2,178	8,660
33	7,155	6,391	12,284	9,436	7,270	12,284
34	9,436	4,643	9,447	8,667	3,726	9,447
35	8,667	4,130	8,709	6,152	5,705	8,709
36	6,152	7,121	10,490	6,920	7,378	10,490
37	6,920	10,831	8,517	8,359	2,689	8,517
38	8,359	3,858	7,739	5,334	5,619	7,739
39	5,334	3,672	6,417	4,804	3,774	6,417
40	4,804	1,451	4,453	3,286	4,997	4,453
41	3,286	8,682	10,100	7,314	6,086	10,100
42	7,314	3,387	8,867	6,057	6,424	8,867

Table 5. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE
Side Lengths of Segments Triangles for 1997 Aerial Photography.

1997 Triangle Lengths (feet)

Segment No.	Left Bank* Upstream X-Section (A)	Left Side (B)	Diagonal Side (C)	Right Bank* Downstream X-Section (A)	Right Side (B)	Diagonal Side (C)
43	6,057	4,081	8,284	7,403	2,647	8,284
44	7,403	6,634	10,514	8,657	5,484	10,514
45	8,657	11,456	9,629	8,341	1,935	9,629
46	8,341	6,346	7,154	5,447	2,362	7,154
47	5,447	3,753	5,633	4,877	4,854	5,633
48	4,877	5,577	7,647	5,844	5,216	7,647
49	5,844	2,621	7,700	4,618	5,704	7,700
50	4,618	3,620	6,087	2,694	5,228	6,087

* Right and left as viewed in a downstream direction.

Table 6. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE Segment Sides (S), Triangle Areas and Total Segment Areas for 1985 Aerial Photography.

Segment No.	(1) Segment Triangle Sides - S Left Triangle	Right Triangle	Triangle Areas (sq. ft.) Left Triangle	Right Triangle	Total Segment Area (2) (sq. ft.)
1	9,009	8,358	14,040,364	10,619,269	24,659,633
2	9,950	11,390	13,167,870	23,575,223	36,743,093
3	8,019	8,889	8,918,212	14,395,409	23,313,621
4	11,044	10,267	20,105,192	14,637,288	34,742,480
5	11,314	13,399	20,007,588	30,052,294	50,059,882
6	11,940	11,809	14,679,760	19,411,831	34,091,591
7	11,572	10,784	19,074,066	17,173,337	36,247,403
8	9,543	8,004	17,390,396	11,452,850	28,843,246
9	8,786	7,937	13,055,278	10,347,553	23,402,831
10	10,429	10,155	18,802,892	18,485,072	37,287,964
11	9,585	10,056	17,188,461	15,143,361	32,331,822
12	9,314	8,992	13,582,236	11,960,547	25,542,783
13	7,388	7,674	8,517,152	9,432,537	17,949,689
14	10,687	9,654	19,877,106	13,460,954	33,338,060
15	12,152	11,505	26,272,611	22,260,323	48,532,934
16	7,916	7,764	6,596,213	6,341,511	12,937,724
17	5,705	7,108	3,057,734	9,317,767	12,375,501
18	8,292	9,124	11,191,078	15,287,937	26,479,015
19	8,428	8,839	10,390,070	11,514,001	21,904,071
20	10,388	9,930	18,301,453	15,530,278	33,831,731
21	10,714	9,925	21,269,758	16,630,025	37,899,783
22	11,676	12,735	18,328,727	27,863,251	46,191,978
23	9,886	9,895	13,951,040	15,056,320	29,007,360
24	11,055	7,766	23,304,673	1,626,022	24,930,695
25	9,867	8,350	18,230,859	10,792,750	29,023,609
26	7,130	6,990	7,311,104	6,674,786	13,985,890
27	6,708	10,879	1,871,937	22,154,980	24,026,917
28	8,426	9,115	5,221,055	15,356,597	20,577,652
29	7,063	9,102	7,661,898	15,539,401	23,201,299
30	10,565	9,059	18,606,924	2,579,381	21,186,305
31	11,403	8,343	23,676,592	4,666,977	28,343,569
32	9,593	8,808	13,380,919	5,773,695	19,154,614
33	12,538	14,049	16,270,368	31,979,249	48,249,617
34	11,329	10,467	19,766,356	14,736,410	34,502,766
35	10,362	9,862	16,242,576	15,957,670	32,200,246
36	11,581	12,213	19,534,675	24,739,476	44,274,151
37	12,966	9,429	28,844,958	10,194,614	39,039,572
38	9,615	8,992	13,891,740	13,878,564	27,770,304
39	7,436	7,257	9,119,838	8,497,719	17,617,557
40	5,136	6,070	2,839,414	6,527,451	9,366,865
41	10,535	11,335	12,155,465	20,807,433	32,962,898
42	9,469	10,262	11,082,993	17,771,704	28,854,697
43	8,998	8,948	11,185,459	9,099,222	20,284,681

Table 6. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE Segment Sides (S), Triangle Areas and Total Segment Areas for 1985 Aerial Photography.

Segment No.	(1) Segment Triangle Sides - S Left Triangle	Right Triangle	Triangle Areas (sq. ft.) Left Triangle	Right Triangle	Total Segment Area (2) (sq. ft.)
44	11,910	12,004	22,950,304	22,561,278	45,511,582
45	14,369	9,554	38,065,455	5,824,299	43,889,754
46	10,510	7,185	20,433,184	4,631,297	25,064,481
47	7,163	7,491	9,099,787	10,642,954	19,742,741
48	8,789	9,042	12,854,314	14,185,117	27,039,431
49	7,829	8,752	5,710,684	12,399,432	18,110,116
50	6,957	6,828	7,799,134	6,677,215	14,476,349

(1) Segment sides S = (A+B+C)/2

(2) Total Segment Area = $(S * (S-A)*(S-B)*(S-C))^{1/2}$

Table 7. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE Segment Sides (S), Triangle Areas and Total Segment Areas for 1995 Aerial Photography.

Segment No.	(1) Segment Triangle Sides - S		Triangle Areas (sq. ft.)		Total Segment Area (2) (sq. ft.)
	Left Triangle	Right Triangle	Left Triangle	Right Triangle	
1	9,473	8,665	15,540,379	11,346,074	26,886,453
2	10,065	11,508	13,591,212	24,249,449	37,840,661
3	8,259	9,315	9,169,169	15,936,968	25,106,137
4	11,507	10,692	21,695,476	15,399,226	37,094,702
5	11,425	13,659	20,326,118	30,858,511	51,184,629
6	12,267	12,125	15,237,098	20,303,689	35,540,787
7	11,836	10,969	19,743,683	17,461,298	37,204,981
8	9,703	8,266	18,013,491	12,360,665	30,374,156
9	8,889	7,997	13,722,582	10,691,108	24,413,690
10	10,104	10,034	17,726,839	17,974,623	35,701,462
11	9,441	9,821	16,751,995	15,033,361	31,785,356
12	9,431	9,082	13,606,387	11,669,561	25,275,948
13	7,371	7,657	8,259,673	9,294,444	17,554,117
14	10,546	9,531	19,334,160	12,942,257	32,276,417
15	11,992	11,529	25,378,688	22,518,527	47,897,215
16	8,081	7,950	6,668,670	6,754,642	13,423,312
17	6,111	7,479	3,254,529	10,090,552	13,345,081
18	8,089	8,988	10,729,413	14,910,953	25,640,366
19	8,290	8,700	10,083,046	11,239,820	21,322,866
20	10,257	9,837	17,783,213	15,298,529	33,081,742
21	10,367	9,567	19,873,741	15,509,830	35,383,571
22	11,476	12,535	17,458,183	26,835,008	44,293,191
23	9,411	9,241	12,461,198	12,337,827	24,799,025
24	10,950	7,842	22,863,245	1,643,199	24,506,444
25	9,628	8,218	17,286,772	10,765,957	28,052,729
26	7,034	6,996	7,216,461	6,421,172	13,637,633
27	6,707	10,676	1,955,883	21,065,087	23,020,970
28	8,501	9,111	5,572,949	15,242,335	20,815,284
29	7,125	9,098	7,745,479	15,591,586	23,337,065
30	10,698	9,231	18,847,121	2,453,816	21,300,937
31	11,622	8,605	24,349,959	5,040,202	29,390,161
32	9,784	9,169	13,713,126	7,820,454	21,533,580
33	12,574	14,073	16,233,000	32,011,403	48,244,403
34	11,260	10,376	19,224,464	14,209,189	33,433,653
35	10,019	9,856	14,196,506	16,164,436	30,360,942
36	11,453	12,057	19,134,807	24,042,702	43,177,509
37	12,527	9,154	27,201,641	9,828,030	37,029,671
38	9,414	8,831	13,386,984	13,486,499	26,873,483
39	7,405	7,183	9,141,508	8,315,950	17,457,458
40	4,976	5,982	2,645,050	6,248,606	8,893,656
41	10,267	10,932	12,200,215	19,447,246	31,647,461
42	9,229	10,045	10,577,486	17,211,840	27,789,326
43	8,881	8,823	10,990,464	8,915,305	19,905,769

Table 7. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE Segment Sides (S), Triangle Areas and Total Segment Areas for 1995 Aerial Photography.

Segment No.	(1) Segment Triangle Sides - S		Triangle Areas (sq. ft.)		Total Segment Area (2) (sq. ft.)
	Left Triangle	Right Triangle	Left Triangle	Right Triangle	
44	11,681	11,547	22,314,447	20,368,331	42,682,778
45	13,951	9,513	36,062,524	5,631,400	41,693,924
46	10,486	7,092	20,353,784	4,732,391	25,086,175
47	7,084	7,406	8,849,517	10,394,340	19,243,857
48	8,731	8,992	12,768,176	14,107,958	26,876,134
49	7,863	8,704	5,817,600	12,041,312	17,858,912
50	6,718	6,648	7,205,204	6,558,066	13,763,270

(1) Segment sides S = (A+B+C)/2

(2) Total Segment Area = $(S * (S-A)*(S-B)*(S-C))^{1/2}$

Table 8. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE Segment Sides (S), Triangle Areas and Total Segment Areas for 1997 Aerial Photography.

Segment No.	(1) Segment Triangle Sides - S Left Triangle	Right Triangle	Triangle Areas (sq. ft.) Left Triangle	Right Triangle	Total Segment Area (2) (sq. ft.)
1	9,273	8,647	14,872,514	11,477,742	26,350,256
2	10,195	11,657	14,021,188	24,789,067	38,810,255
3	8,293	9,155	9,710,729	15,312,473	25,023,202
4	11,444	10,680	21,429,161	15,923,079	37,352,240
5	11,741	14,057	21,701,862	33,063,817	54,765,679
6	12,577	12,356	15,984,092	20,871,296	36,855,388
7	11,950	11,118	20,189,846	18,129,665	38,319,511
8	9,916	8,393	18,777,652	12,645,822	31,423,474
9	9,004	8,136	13,959,865	10,907,491	24,867,356
10	10,742	10,505	19,720,739	19,597,323	39,318,062
11	9,841	10,220	18,191,747	15,883,677	34,075,424
12	9,646	9,372	14,295,392	12,891,331	27,186,723
13	7,585	8,078	8,887,747	10,759,294	19,647,041
14	11,172	9,981	22,176,995	14,556,162	36,733,157
15	12,687	11,847	28,790,890	23,099,949	51,890,839
16	8,085	7,882	6,939,089	6,398,612	13,337,701
17	5,978	7,386	3,212,742	9,940,471	13,153,213
18	8,397	9,345	11,459,804	16,165,096	27,624,900
19	8,652	9,064	10,985,405	12,157,893	23,143,298
20	10,616	10,175	18,991,433	16,264,584	35,256,017
21	10,962	10,097	22,174,696	16,809,656	38,984,352
22	11,667	12,897	18,058,354	28,972,065	47,030,419
23	10,127	10,077	14,778,497	15,565,676	30,344,173
24	11,548	8,218	25,404,256	2,033,540	27,437,796
25	10,218	8,594	19,578,121	11,393,922	30,972,043
26	7,544	7,421	8,196,235	7,308,942	15,505,177
27	6,841	11,165	1,706,442	23,293,255	24,999,697
28	8,699	9,266	5,810,228	15,845,906	21,656,134
29	7,301	9,358	8,224,827	16,442,562	24,667,389
30	11,010	9,446	20,184,563	2,766,344	22,950,907
31	11,896	8,765	25,689,062	5,606,400	31,295,462
32	9,820	8,997	14,259,564	6,165,377	20,424,941
33	12,915	14,495	17,499,680	34,225,890	51,725,570
34	11,763	10,920	21,245,478	16,146,504	37,391,982
35	10,753	10,283	17,425,683	17,495,557	34,921,240
36	11,882	12,394	21,235,471	25,454,840	46,690,311
37	13,134	9,783	29,458,528	11,180,598	40,639,126
38	9,978	9,346	14,878,116	14,985,836	29,863,952
39	7,712	7,498	9,791,394	9,013,735	18,805,129
40	5,354	6,368	3,217,972	7,178,289	10,396,261
41	11,034	11,750	13,704,191	22,070,811	35,775,002
42	9,784	10,674	11,906,375	19,454,366	31,360,741
43	9,211	9,167	11,753,921	9,648,661	21,402,582

Table 8. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE Segment Sides (S), Triangle Areas and Total Segment Areas for 1997 Aerial Photography.

Segment No.	(1) Segment Triangle Sides - S		Triangle Areas (sq. ft.)		Total Segment Area (2) (sq. ft.)
	Left Triangle	Right Triangle	Left Triangle	Right Triangle	
44	12,276	12,328	24,380,025	23,697,255	48,077,280
45	14,871	9,953	40,672,379	6,449,676	47,122,055
46	10,921	7,482	22,030,778	5,051,759	27,082,537
47	7,417	7,682	9,769,271	11,174,144	20,943,415
48	9,051	9,354	13,569,891	15,224,108	28,793,999
49	8,083	9,011	6,147,848	13,100,430	19,248,278
50	7,163	7,005	8,332,852	7,015,167	15,348,019

(1) Segment sides S = (A+B+C)/2

(2) Total Segment Area = $(S * (S-A)*(S-B)*(S-C))^{1/2}$

Table 9. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE Distortion and Area Correction Factors (DCF and ACF) for 1985 and 1995 Aerial Photography.

Segment No.	1985 Segment Area (sq. ft.)	1995 Segment Area (sq. ft.)	Distortion Correction Factors (DCF) 1985 (1)	1995 (2)	1985 SSCF	(3) Area Correction Factors (ACF) 1985	1995
1	24,659,633	26,886,453	1.000	0.917	1.000	1.000	0.917
2	36,743,093	37,840,661	1.000	0.971	0.997	0.997	0.968
3	23,313,621	25,106,137	1.000	0.929	0.998	0.998	0.927
4	34,742,480	37,094,702	1.000	0.937	1.001	1.001	0.938
5	50,059,882	51,184,629	1.000	0.978	0.996	0.996	0.974
6	34,091,591	35,540,787	1.000	0.959	0.994	0.994	0.953
7	36,247,403	37,204,981	1.000	0.974	0.998	0.998	0.972
8	28,843,246	30,374,156	1.000	0.950	1.005	1.005	0.955
9	23,402,831	24,413,690	1.000	0.959	1.002	1.002	0.961
10	37,287,964	35,701,462	1.000	1.044	0.971	0.971	1.014
11	32,331,822	31,785,356	1.000	1.017	0.972	0.972	0.989
12	25,542,783	25,275,948	1.000	1.011	0.980	0.980	0.991
13	17,949,689	17,554,117	1.000	1.023	0.997	0.997	1.020
14	33,338,060	32,276,417	1.000	1.033	1.028	1.028	1.062
15	48,532,934	47,897,215	1.000	1.013	1.007	1.007	1.020
16	12,937,724	13,423,312	1.000	0.964	0.972	0.972	0.937
17	12,375,501	13,345,081	1.000	0.927	1.009	1.009	0.935
18	26,479,015	25,640,366	1.000	1.033	1.031	1.031	1.065
19	21,904,071	21,322,866	1.000	1.027	0.995	0.995	1.022
20	33,831,731	33,081,742	1.000	1.023	1.003	1.003	1.026
21	37,899,783	35,383,571	1.000	1.071	0.988	0.988	1.058
22	46,191,978	44,293,191	1.000	1.043	0.986	0.986	1.028
23	29,007,360	24,799,025	1.000	1.170	1.010	1.010	1.182
24	24,930,695	24,506,444	1.000	1.017	1.054	1.054	1.072
25	29,023,609	28,052,729	1.000	1.035	1.024	1.024	1.060
26	13,985,890	13,637,633	1.000	1.026	0.978	0.978	1.003
27	24,026,917	23,020,970	1.000	1.044	1.004	1.004	1.048
28	20,577,652	20,815,284	1.000	0.989	1.003	1.003	0.992
29	23,201,299	23,337,065	1.000	0.994	1.003	1.003	0.997
30	21,186,305	21,300,937	1.000	0.995	1.045	1.045	1.040
31	28,343,569	29,390,161	1.000	0.964	1.045	1.045	1.007
32	19,154,614	21,533,580	1.000	0.890	0.988	0.988	0.879
33	48,249,617	48,244,403	1.000	1.000	0.988	0.988	0.988
34	34,502,766	33,433,653	1.000	1.032	1.002	1.002	1.034
35	32,200,246	30,360,942	1.000	1.061	1.002	1.002	1.063
36	44,274,151	43,177,509	1.000	1.025	0.996	0.996	1.021
37	39,039,572	37,029,671	1.000	1.054	0.998	0.998	1.052
38	27,770,304	26,873,483	1.000	1.033	1.013	1.013	1.046
39	17,617,557	17,457,458	1.000	1.009	1.012	1.012	1.021
40	9,366,865	8,893,656	1.000	1.053	0.992	0.992	1.045
41	32,962,898	31,647,461	1.000	1.042	1.045	1.045	1.089
42	28,854,697	27,789,326	1.000	1.038	1.053	1.053	1.093
43	20,284,681	19,905,769	1.000	1.019	0.964	0.964	0.982
44	45,511,582	42,682,778	1.000	1.066	0.961	0.961	1.024

Table 9. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE Distortion and Area Correction Factors (DCF and ACF) for 1985 and 1995 Aerial Photography.

Segment No.	1985 Segment Area (sq. ft.)	1995 Segment Area (sq. ft.)	Distortion Correction Factors (DCF) 1985 (1)	1995 (2)	1985 SSCF	(3) Area Correction Factors (ACF) 1985	1995
45	43,889,754	41,693,924	1.000	1.053	1.010	1.010	1.064
46	25,064,481	25,086,175	1.000	0.999	1.013	1.013	1.012
47	19,742,741	19,243,857	1.000	1.026	1.000	1.000	1.026
48	27,039,431	26,876,134	1.000	1.006	1.004	1.004	1.010
49	18,110,116	17,858,912	1.000	1.014	1.004	1.004	1.018
50	14,476,349	13,763,270	1.000	1.052	1.004	1.004	1.056

(1) 1985 DCF = 1.0

(2) 1995 DCF = $\frac{\text{1985 segment area}}{\text{1995 segment area}}$

(3) ACF = (DCF)* (1985 SSCF)

Table 10. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE Distortion and Area Correction Factors (DCF and ACF) for 1995 and 1997 Aerial Photography.

Segment No.	1995 Segment Area (sq. ft.)	1997 Segment Area (sq. ft.)	Distortion Correction Factors (DCF) 1995 (1)	1997 (2)	1995 SSCF	(3) Area Correction Factors (ACF) 1995	1997
1	26,886,453	26,350,256	1.000	1.020	1.000	1.000	1.020
2	37,840,661	38,810,255	1.000	0.975	1.000	1.000	0.975
3	25,106,137	25,023,202	1.000	1.003	1.000	1.000	1.003
4	37,094,702	37,352,240	1.000	0.993	1.000	1.000	0.993
5	51,184,629	54,765,679	1.000	0.935	1.000	1.000	0.935
6	35,540,787	36,855,388	1.000	0.964	1.000	1.000	0.964
7	37,204,981	38,319,511	1.000	0.971	1.000	1.000	0.971
8	30,374,156	31,423,474	1.000	0.967	1.000	1.000	0.967
9	24,413,690	24,867,356	1.000	0.982	1.000	1.000	0.982
10	35,701,462	39,318,062	1.000	0.908	1.000	1.000	0.908
11	31,785,356	34,075,424	1.000	0.933	1.000	1.000	0.933
12	25,275,948	27,186,723	1.000	0.930	1.000	1.000	0.930
13	17,554,117	19,647,041	1.000	0.893	1.000	1.000	0.893
14	32,276,417	36,733,157	1.000	0.879	1.000	1.000	0.879
15	47,897,215	51,890,839	1.000	0.923	1.000	1.000	0.923
16	13,423,312	13,337,701	1.000	1.006	1.000	1.000	1.006
17	13,345,081	13,153,213	1.000	1.015	1.000	1.000	1.015
18	25,640,366	27,624,900	1.000	0.928	1.000	1.000	0.928
19	21,322,866	23,143,298	1.000	0.921	1.000	1.000	0.921
20	33,081,742	35,256,017	1.000	0.938	1.000	1.000	0.938
21	35,383,571	38,984,352	1.000	0.908	1.000	1.000	0.908
22	44,293,191	47,030,419	1.000	0.942	1.000	1.000	0.942
23	24,799,025	30,344,173	1.000	0.817	1.000	1.000	0.817
24	24,506,444	27,437,796	1.000	0.893	1.000	1.000	0.893
25	28,052,729	30,972,043	1.000	0.906	1.000	1.000	0.906
26	13,637,633	15,505,177	1.000	0.880	1.000	1.000	0.880
27	23,020,970	24,999,697	1.000	0.921	1.000	1.000	0.921
28	20,815,284	21,656,134	1.000	0.961	1.000	1.000	0.961
29	23,337,065	24,667,389	1.000	0.946	1.000	1.000	0.946
30	21,300,937	22,950,907	1.000	0.928	1.000	1.000	0.928
31	29,390,161	31,295,462	1.000	0.939	1.000	1.000	0.939
32	21,533,580	20,424,941	1.000	1.054	1.000	1.000	1.054
33	48,244,403	51,725,570	1.000	0.933	1.000	1.000	0.933
34	33,433,653	37,391,982	1.000	0.894	1.000	1.000	0.894
35	30,360,942	34,921,240	1.000	0.869	1.000	1.000	0.869
36	43,177,509	46,690,311	1.000	0.925	1.000	1.000	0.925
37	37,029,671	40,639,126	1.000	0.911	1.000	1.000	0.911
38	26,873,483	29,863,952	1.000	0.900	1.000	1.000	0.900
39	17,457,458	18,805,129	1.000	0.928	1.000	1.000	0.928
40	8,893,656	10,396,261	1.000	0.855	1.000	1.000	0.855
41	31,647,461	35,775,002	1.000	0.885	1.000	1.000	0.885
42	27,789,326	31,360,741	1.000	0.886	1.000	1.000	0.886
43	19,905,769	21,402,582	1.000	0.930	1.000	1.000	0.930
44	42,682,778	48,077,280	1.000	0.888	1.000	1.000	0.888

Table 10. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE Distortion and Area Correction Factors (DCF and ACF) for 1995 and 1997 Aerial Photography.

Segment No.	1995 Segment Area (sq. ft.)	1997 Segment Area (sq. ft.)	Distortion Correction Factors (DCF) 1995 (1)	1997 (2)	1995 SSCF	(3) Area Correction Factors (ACF) 1995	1997
45	41,693,924	47,122,055	1.000	0.885	1.000	1.000	0.885
46	25,086,175	27,082,537	1.000	0.926	1.000	1.000	0.926
47	19,243,857	20,943,415	1.000	0.919	1.000	1.000	0.919
48	26,876,134	28,793,999	1.000	0.933	1.000	1.000	0.933
49	17,858,912	19,248,278	1.000	0.928	1.000	1.000	0.928
50	13,763,270	15,348,019	1.000	0.897	1.000	1.000	0.897

(1) 1995 DCF = 1.0

(2) 1997 DCF = $\frac{\text{1995 segment area}}{\text{1997 segment area}}$

(3) ACF = (DCF)* (1995 SSCF)

Table 11. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE
1985 Measured and Corrected Bankline Areas for 1985/1995 Assessment.

Segment No.	1985 ACF	(1) Measured Bankline Areas (sq. ft.) Left	Right	(2) Corrected Bankline Areas (sq. ft.) Left	Right
1	1.000	5,220,609	8,534,323	5,220,609	8,534,323
2	0.997	7,181,423	9,237,598	7,159,879	9,209,885
3	0.998	7,134,412	7,383,655	7,120,143	7,368,887
4	1.001	10,248,116	7,626,760	10,258,364	7,634,386
5	0.996	12,194,084	5,332,147	12,145,308	5,310,818
6	0.994	7,134,844	7,699,978	7,092,035	7,653,778
7	0.998	6,216,445	6,032,720	6,204,012	6,020,655
8	1.005	6,823,643	5,585,496	6,857,761	5,613,423
9	1.002	5,158,387	2,602,208	5,168,704	2,607,412
10	0.971	8,074,219	5,323,907	7,840,067	5,169,514
11	0.972	4,571,620	6,315,872	4,443,615	6,139,028
12	0.980	5,557,743	8,263,241	5,446,588	8,097,976
13	0.997	5,452,809	4,945,544	5,436,451	4,930,708
14	1.028	8,310,262	5,182,329	8,542,949	5,327,434
15	1.007	9,352,271	7,937,901	9,417,737	7,993,466
16	0.972	3,655,523	3,543,496	3,553,168	3,444,278
17	1.009	2,548,273	3,223,259	2,571,207	3,252,268
18	1.031	4,562,448	3,099,200	4,703,884	3,195,275
19	0.995	1,722,070	2,955,743	1,713,460	2,940,964
20	1.003	3,072,684	2,781,934	3,081,902	2,790,280
21	0.988	2,759,439	10,176,810	2,726,326	10,054,688
22	0.986	7,294,614	9,645,518	7,192,489	9,510,481
23	1.010	5,013,911	7,209,172	5,064,051	7,281,264
24	1.054	5,929,358	2,695,315	6,249,543	2,840,862
25	1.024	6,734,117	2,814,561	6,895,736	2,882,110
26	0.978	2,646,201	3,776,917	2,587,984	3,693,825
27	1.004	2,350,647	3,873,668	2,360,050	3,889,163
28	1.003	5,127,601	5,367,279	5,142,984	5,383,380
29	1.003	4,411,360	4,958,400	4,424,594	4,973,275
30	1.045	7,309,905	3,242,804	7,638,851	3,388,730
31	1.045	5,814,132	9,025,015	6,075,768	9,431,140
32	0.988	4,152,139	4,822,686	4,102,313	4,764,814
33	0.988	8,990,909	13,562,558	8,883,018	13,399,807
34	1.002	4,417,687	8,675,178	4,426,522	8,692,528
35	1.002	6,849,091	19,476,395	6,862,789	19,515,348
36	0.996	14,513,772	5,455,163	14,455,717	5,433,342
37	0.998	13,876,552	5,539,071	13,848,799	5,527,993
38	1.013	11,202,455	4,337,358	11,348,087	4,393,744
39	1.012	6,449,919	1,063,056	6,527,318	1,075,813
40	0.992	930,812	2,762,679	923,365	2,740,578
41	1.045	9,397,312	6,702,792	9,820,191	7,004,418
42	1.053	3,872,859	8,545,938	4,078,121	8,998,872
43	0.964	3,054,434	4,766,863	2,944,474	4,595,256
44	0.961	10,187,915	11,679,527	9,790,586	11,224,026
45	1.010	12,849,050	5,796,620	12,977,541	5,854,586

Table 11. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE 1985 Measured and Corrected Bankline Areas for 1985/1995 Assessment.

Segment No.	1985 ACF	(1) Measured Bankline Areas (sq. ft.) Left	Right	(2) Corrected Bankline Areas (sq. ft.) Left	Right
46	1.013	6,721,320	4,603,632	6,808,697	4,663,479
47	1.000	1,789,314	9,629,750	1,789,314	9,629,750
48	1.004	6,029,866	4,037,931	6,053,985	4,054,083
49	1.004	4,216,028	3,600,501	4,232,892	3,614,903
50	1.004	4,797,235	2,534,940	4,816,424	2,545,080

(1) Measured Bankline Area = Area bound by bankline, upstream cross section, downstream cross section and segment side.

(2) Corrected Bankline Areas = (Measured Bankline Area) * (ACF)

(3) Compound bank area in which bank area is in- and outside of quadrilateral due to segment point location(s).

Table 12. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE
1995 Measured and Corrected Bankline Areas for 1985/1995 Assessment.

Segment No.	1995 ACF	(1) Measured Bankline Areas (sq. ft.) Left	Right	(2) Corrected Bankline Areas (sq. ft.) Left	Right
1	0.917	5,421,626	9,358,838	4,971,631	8,582,054
2	0.968	7,458,020	9,361,063	7,219,363	9,061,509
3	0.927	6,834,887	9,057,774	6,335,940	8,396,556
4	0.938	10,939,422	8,790,871	10,261,178	8,245,837
5	0.974	11,878,949	6,529,819	11,570,096	6,360,044
6	0.953	7,174,407	8,649,103	6,837,210	8,242,595
7	0.972	6,190,222	6,359,909	6,016,896	6,181,832
8	0.955	7,234,473	5,870,603	6,908,922	5,606,426
9	0.961	5,605,316	2,366,733	5,386,709	2,274,430
10	1.014	7,755,376	4,764,784	7,863,951	4,831,491
11	0.989	3,181,224	6,342,126	3,146,231	6,272,363
12	0.991	4,778,970	8,250,346	4,735,959	8,176,093
13	1.020	5,094,625	4,514,068	5,196,518	4,604,349
14	1.062	8,049,387	4,831,590	8,548,449	5,131,149
15	1.020	9,193,696	7,867,828	9,377,570	8,025,185
16	0.937	3,854,229	3,711,072	3,611,413	3,477,274
17	0.935	2,612,455	3,433,096	2,442,645	3,209,945
18	1.065	4,293,626	2,781,054	4,572,712	2,961,823
19	1.022	1,591,012	2,899,254	1,626,014	2,963,038
20	1.026	3,004,369	2,732,404	3,082,483	2,803,447
21	1.058	2,477,001	9,472,173	2,620,667	10,021,559
22	1.028	6,244,849	9,158,497	6,419,705	9,414,935
23	1.182	4,273,399	4,697,957	5,051,158	5,552,985
24	1.072	5,741,959	2,340,043	6,155,380	2,508,526
25	1.060	5,991,724	3,307,589	6,351,227	3,506,044
26	1.003	2,877,350	3,889,221	2,885,982	3,900,889
27	1.048	2,140,769	4,518,501	2,243,526	4,735,389
28	0.992	4,502,467	5,486,698	4,466,447	5,442,804
29	0.997	3,998,636	4,837,310	3,986,640	4,822,798
30	1.040	7,300,421	2,607,695	7,592,438	2,712,003
31	1.007	5,892,463	7,887,682	5,933,710	7,942,896
32	0.879	3,849,202	4,924,331	3,383,449	4,328,487
33	0.988	8,568,220	13,510,119	8,465,401	13,347,998
34	1.034	4,252,024	7,893,860	4,396,593	8,162,251
35	1.063	6,137,858	16,864,632	6,524,543	17,927,104
36	1.021	14,290,134	5,177,905	14,590,227	5,286,641
37	1.052	11,961,224	4,965,296	12,583,208	5,223,491
38	1.046	10,555,083	3,978,954	11,040,617	4,161,986
39	1.021	6,925,802	586,909	7,071,244	599,234
40	1.045	842,949	2,258,853	880,882	2,360,501
41	1.089	9,482,998	5,780,447	10,326,985	6,294,907
42	1.093	4,022,117	7,965,023	4,396,174	8,705,770
43	0.982	3,081,531	4,601,941	3,026,063	4,519,106
44	1.024	9,389,899	11,072,910	9,615,257	11,338,660
45	1.064	12,244,134	5,262,600	13,027,759	5,599,406

Table 12. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE 1995 Measured and Corrected Bankline Areas for 1985/1995 Assessment.

Segment No.	1995 ACF	(1) Measured Bankline Areas (sq. ft.) Left	Right	(2) Corrected Bankline Areas (sq. ft.) Left	Right
46	1.012	6,783,634	3,593,918	6,865,038	3,637,045
47	1.026	1,575,631	10,404,532	1,616,597	10,675,050
48	1.010	5,846,915	3,867,414	5,905,384	3,906,088
49	1.018	4,227,375	3,232,041	4,303,468	3,290,218
50	1.056	4,533,463	2,522,380	4,787,337	2,663,633

(1) Measured Bankline Area = Area bound by bankline, upstream cross section, downstream cross section and segment side.

(2) Corrected Bankline Areas = (Measured Bankline Area) * (ACF)

Table 13. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE
1995 Measured and Corrected Bankline Areas for 1995/1997 Assessment.

Segment No.	1995 ACF	(1) Measured Bankline Areas (sq. ft.) Left	Right	(2) Corrected Bankline Areas (sq. ft.) Left	Right
1	1.000	5,421,626	9,358,838	5,421,626	9,358,838
2	1.000	7,458,020	9,361,063	7,458,020	9,361,063
3	1.000	6,834,887	9,057,774	6,834,887	9,057,774
4	1.000	10,939,422	8,790,871	10,939,422	8,790,871
5	1.000	11,878,949	6,529,819	11,878,949	6,529,819
6	1.000	7,174,407	8,649,103	7,174,407	8,649,103
7	1.000	6,190,222	6,359,909	6,190,222	6,359,909
8	1.000	7,234,473	5,870,603	7,234,473	5,870,603
9	1.000	5,605,316	2,366,733	5,605,316	2,366,733
10	1.000	7,755,376	4,764,784	7,755,376	4,764,784
11	1.000	3,181,224	6,342,126	3,181,224	6,342,126
12	1.000	4,778,970	8,250,346	4,778,970	8,250,346
13	1.000	5,094,625	4,514,068	5,094,625	4,514,068
14	1.000	8,049,387	4,831,590	8,049,387	4,831,590
15	1.000	9,193,696	7,867,828	9,193,696	7,867,828
16	1.000	3,854,229	3,711,072	3,854,229	3,711,072
17	1.000	2,612,455	3,433,096	2,612,455	3,433,096
18	1.000	4,293,626	2,781,054	4,293,626	2,781,054
19	1.000	1,591,012	2,899,254	1,591,012	2,899,254
20	1.000	3,004,369	2,732,404	3,004,369	2,732,404
21	1.000	2,477,001	9,472,173	2,477,001	9,472,173
22	1.000	6,244,849	9,158,497	6,244,849	9,158,497
23	1.000	4,273,399	4,697,957	4,273,399	4,697,957
24	1.000	5,741,959	2,340,043	5,741,959	2,340,043
25	1.000	5,991,724	3,307,589	5,991,724	3,307,589
26	1.000	2,877,350	3,889,221	2,877,350	3,889,221
27	1.000	2,140,769	4,518,501	2,140,769	4,518,501
28	1.000	4,502,467	5,486,698	4,502,467	5,486,698
29	1.000	3,998,636	4,837,310	3,998,636	4,837,310
30	1.000	7,300,421	2,607,695	7,300,421	2,607,695
31	1.000	5,892,463	7,887,682	5,892,463	7,887,682
32	1.000	3,849,202	4,924,331	3,849,202	4,924,331
33	1.000	8,568,220	13,510,119	8,568,220	13,510,119
34	1.000	4,252,024	7,893,860	4,252,024	7,893,860
35	1.000	6,137,858	16,864,632	6,137,858	16,864,632
36	1.000	14,290,134	5,177,905	14,290,134	5,177,905
37	1.000	11,961,224	4,965,296	11,961,224	4,965,296
38	1.000	10,555,083	3,978,954	10,555,083	3,978,954
39	1.000	6,925,802	586,909	6,925,802	586,909
40	1.000	842,949	2,258,853	842,949	2,258,853
41	1.000	9,482,998	5,780,447	9,482,998	5,780,447
42	1.000	4,022,117	7,965,023	4,022,117	7,965,023
43	1.000	3,081,531	4,601,941	3,081,531	4,601,941
44	1.000	9,389,899	11,072,910	9,389,899	11,072,910
45	1.000	12,244,134	5,262,600	12,244,134	5,262,600

Table 13. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE 1995 Measured and Corrected Bankline Areas for 1995/1997 Assessment.

Segment No.	1995 ACF	(1) Measured Bankline Areas (sq. ft.) Left	Right	(2) Corrected Bankline Areas (sq. ft.) Left	Right
46	1.000	6,783,634	3,593,918	6,783,634	3,593,918
47	1.000	1,575,631	10,404,532	1,575,631	10,404,532
48	1.000	5,846,915	3,867,414	5,846,915	3,867,414
49	1.000	4,227,375	3,232,041	4,227,375	3,232,041
50	1.000	4,533,463	2,522,380	4,533,463	2,522,380

(1) Measured Bankline Area = Area bound by bankline, upstream cross section, downstream cross section and segment side.

(2) Corrected Bankline Areas = (Measured Bankline Area) * (ACF)

Table 14. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE
1997 Measured and Corrected Bankline Areas for 1995/1997 Assessment.

Segment No.	1997 ACF	(1) Measured Bankline Areas (sq. ft.) Left	Right	(2) Corrected Bankline Areas (sq. ft.) Left	Right
1	1.020	5,589,764	9,182,971	5,701,559	9,366,630
2	0.975	7,223,848	9,466,923	7,043,252	9,230,250
3	1.003	7,494,552	7,745,082	7,517,036	7,768,317
4	0.993	11,020,466	7,712,589	10,943,323	7,658,601
5	0.935	13,326,096	6,719,163	12,459,900	6,282,417
6	0.964	7,652,773	8,845,526	7,377,273	8,527,087
7	0.971	6,578,904	6,126,631	6,388,116	5,948,959
8	0.967	7,288,857	5,682,645	7,048,325	5,495,118
9	0.982	5,457,701	2,225,088	5,359,462	2,185,036
10	0.908	8,155,012	5,240,609	7,404,751	4,758,473
11	0.933	3,136,228	6,743,554	2,926,101	6,291,736
12	0.930	5,254,133	8,793,806	4,886,344	8,178,240
13	0.893	5,783,441	5,135,201	5,164,613	4,585,734
14	0.879	8,844,231	5,600,286	7,774,079	4,922,651
15	0.923	9,475,119	8,459,864	8,745,535	7,808,454
16	1.006	3,760,973	3,377,593	3,783,539	3,397,859
17	1.015	2,730,054	2,971,777	2,771,005	3,016,354
18	0.928	4,825,194	2,759,295	4,477,780	2,560,626
19	0.921	1,702,199	3,103,087	1,567,725	2,857,943
20	0.938	3,278,132	2,858,386	3,074,888	2,681,166
21	0.908	3,133,644	9,494,523	2,845,349	8,621,027
22	0.942	7,302,474	8,111,557	6,878,931	7,641,087
23	0.817	5,302,211	5,377,084	4,331,906	4,393,078
24	0.893	5,422,404	2,306,859	4,842,207	2,060,025
25	0.906	5,512,577	2,879,292	4,994,395	2,608,639
26	0.880	3,154,578	3,859,286	2,776,029	3,396,172
27	0.921	2,218,300	3,795,428	2,043,054	3,495,589
28	0.961	4,033,700	5,578,972	3,876,386	5,361,392
29	0.946	4,682,751	5,055,719	4,429,882	4,782,710
30	0.928	7,739,955	2,985,657	7,182,678	2,770,690
31	0.939	6,145,864	8,033,523	5,770,966	7,543,478
32	1.054	4,234,511	5,748,034	4,463,175	6,058,428
33	0.933	9,560,811	13,975,710	8,920,237	13,039,337
34	0.894	4,730,022	8,790,316	4,228,640	7,858,543
35	0.869	7,187,088	18,027,726	6,245,579	15,666,094
36	0.925	14,842,523	5,542,617	13,729,334	5,126,921
37	0.911	11,653,293	5,904,648	10,616,150	5,379,134
38	0.900	11,450,545	4,413,952	10,305,491	3,972,557
39	0.928	6,816,177	642,861	6,325,412	596,575
40	0.855	875,592	2,933,632	748,631	2,508,255
41	0.885	10,051,753	7,105,160	8,895,801	6,288,067
42	0.886	4,383,887	8,948,416	3,884,124	7,928,297
43	0.930	3,167,449	4,973,198	2,945,728	4,625,074
44	0.888	10,559,022	12,220,644	9,376,412	10,851,932
45	0.885	13,478,252	5,839,047	11,928,253	5,167,557

Table 14. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE 1997 Measured and Corrected Bankline Areas for 1995/1997 Assessment.

Segment No.	1997 ACF	(1) Measured Bankline Areas (sq. ft.) Left	Right	(2) Corrected Bankline Areas (sq. ft.) Left	Right
46	0.926	7,108,631	3,671,147	6,582,592	3,399,482
47	0.919	1,758,306	10,325,990	1,615,883	9,489,585
48	0.933	6,246,648	4,432,989	5,828,123	4,135,979
49	0.928	4,544,344	3,215,611	4,217,151	2,984,087
50	0.897	5,067,254	2,678,094	4,545,327	2,402,250

(1) Measured Bankline Area = Area bound by bankline, upstream cross section, downstream cross section and segment side.

(2) Corrected Bankline Areas = (Measured Bankline Area) * (ACF)

Table 15. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE
Change in Corrected Bankline Areas Between 1985 and 1995 Aerial Photography (1).

Segment No.	1985 Corrected Bankline Areas (sq. ft.)		1995 Corrected Bankline Areas (sq. ft.)		(2) Change Between 1985 and 1995 Bankline Areas (AC)	
	Left	Right	Left	Right	Left	Right
1	5,220,609	8,534,323	4,971,631	8,582,054	5.716	0.000
2	7,159,879	9,209,885	7,219,363	9,061,509	0.000	3.406
3	7,120,143	7,368,887	6,335,940	8,396,556	18.003	0.000
4	10,258,364	7,634,386	10,261,178	8,245,837	0.000	0.000
5	12,145,308	5,310,818	11,570,096	6,360,044	13.205	0.000
6	7,092,035	7,653,778	6,837,210	8,242,595	5.850	0.000
7	6,204,012	6,020,655	6,016,896	6,181,832	4.296	0.000
8	6,857,761	5,613,423	6,908,922	5,606,426	0.000	0.161
9	5,168,704	2,607,412	5,386,709	2,274,430	0.000	7.644
10	7,840,067	5,169,514	7,863,951	4,831,491	0.000	7.760
11	4,443,615	6,139,028	3,146,231	6,272,363	29.784	0.000
12	5,446,588	8,097,976	4,735,959	8,176,093	16.314	0.000
13	5,436,451	4,930,708	5,196,518	4,604,349	5.508	7.492
14	8,542,949	5,327,434	8,548,449	5,131,149	0.000	4.506
15	9,417,737	7,993,466	9,377,570	8,025,185	0.922	0.000
16	3,553,168	3,444,278	3,611,413	3,477,274	0.000	0.000
17	2,571,207	3,252,268	2,442,645	3,209,945	2.951	0.972
18	4,703,884	3,195,275	4,572,712	2,961,823	3.011	5.359
19	1,713,460	2,940,964	1,626,014	2,963,038	2.007	0.000
20	3,081,902	2,790,280	3,082,483	2,803,447	0.000	0.000
21	2,726,326	10,054,688	2,620,667	10,021,559	2.426	0.761
22	7,192,489	9,510,481	6,419,705	9,414,935	17.741	2.193
23	5,064,051	7,281,264	5,051,158	5,552,985	0.296	39.676
24	6,249,543	2,840,862	6,155,380	2,508,526	2.162	7.629
25	6,895,736	2,882,110	6,351,227	3,506,044	12.500	0.000
26	2,587,984	3,693,825	2,885,982	3,900,889	0.000	0.000
27	2,360,050	3,889,163	2,243,526	4,735,389	2.675	0.000
28	5,142,984	5,383,380	4,466,447	5,442,804	15.531	0.000
29	4,424,594	4,973,275	3,986,640	4,822,798	10.054	3.454
30	7,638,851	3,388,730	7,592,438	2,712,003	1.065	15.536
31	6,075,768	9,431,140	5,933,710	7,942,896	3.261	34.165
32	4,102,313	4,764,814	3,383,449	4,328,487	16.503	10.017
33	8,883,018	13,399,807	8,465,401	13,347,998	9.587	1.189
34	4,426,522	8,692,528	4,396,593	8,162,251	0.687	12.173
35	6,862,789	19,515,348	6,524,543	17,927,104	7.765	36.461
36	14,455,717	5,433,342	14,590,227	5,286,641	0.000	3.368
37	13,848,799	5,527,993	12,583,208	5,223,491	29.054	6.990
38	11,348,087	4,393,744	11,040,617	4,161,986	7.059	5.320
39	6,527,318	1,075,813	7,071,244	599,234	0.000	10.941
40	923,365	2,740,578	880,882	2,360,501	0.975	8.725
41	9,820,191	7,004,418	10,326,985	6,294,907	0.000	16.288

Table 15. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE
Change in Corrected Bankline Areas Between 1985 and 1995 Aerial Photography (1).

Segment No.	1985 Corrected Bankline Areas (sq. ft.)		1995 Corrected Bankline Areas (sq. ft.)		(2) Change Between 1985 and 1995 Bankline Areas (AC)	
	Left	Right	Left	Right	Left	Right
42	4,078,121	8,998,872	4,396,174	8,705,770	0.000	6.729
43	2,944,474	4,595,256	3,026,063	4,519,106	0.000	1.748
44	9,790,586	11,224,026	9,615,257	11,338,660	4.025	0.000
45	12,977,541	5,854,586	13,027,759	5,599,406	0.000	5.858
46	6,808,697	4,663,479	6,865,038	3,637,045	0.000	23.564
47	1,789,314	9,629,750	1,616,597	10,675,050	3.965	0.000
48	6,053,985	4,054,083	5,905,384	3,906,088	3.411	3.397
49	4,232,892	3,614,903	4,303,468	3,290,218	0.000	7.454
50	4,816,424	2,545,080	4,787,337	2,663,633	0.668	0.000

(1) Net increase in acres are shown as no change in bankline areas.

(2) Change in Acres = $\frac{\text{Change in Square Feet}}{43560}$

Table 16. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE
Change in Corrected Bankline Areas Between 1995 and 1997 Aerial Photography (1).

Segment No.	1995 Corrected Bankline Areas (sq. ft.)		1997 Corrected Bankline Areas (sq. ft.)		(2) Change Between 1995 and 1997 Bankline Areas (AC)	
	Left	Right	Left	Right	Left	Right
1	5,421,626	9,358,838	5,701,559	9,366,630	0.000	0.000
2	7,458,020	9,361,063	7,043,252	9,230,250	9.522	3.003
3	6,834,887	9,057,774	7,517,036	7,768,317	0.000	29.602
4	10,939,422	8,790,871	10,943,323	7,658,601	0.000	25.993
5	11,878,949	6,529,819	12,459,900	6,282,417	0.000	5.680
6	7,174,407	8,649,103	7,377,273	8,527,087	0.000	2.801
7	6,190,222	6,359,909	6,388,116	5,948,959	0.000	9.434
8	7,234,473	5,870,603	7,048,325	5,495,118	4.273	8.620
9	5,605,316	2,366,733	5,359,462	2,185,036	5.644	4.171
10	7,755,376	4,764,784	7,404,751	4,758,473	8.049	0.145
11	3,181,224	6,342,126	2,926,101	6,291,736	5.857	1.157
12	4,778,970	8,250,346	4,886,344	8,178,240	0.000	1.655
13	5,094,625	4,514,068	5,164,613	4,585,734	0.000	0.000
14	8,049,387	4,831,590	7,774,079	4,922,651	6.320	0.000
15	9,193,696	7,867,828	8,745,535	7,808,454	10.288	1.363
16	3,854,229	3,711,072	3,783,539	3,397,859	1.623	7.190
17	2,612,455	3,433,096	2,771,005	3,016,354	0.000	9.567
18	4,293,626	2,781,054	4,477,780	2,560,626	0.000	5.060
19	1,591,012	2,899,254	1,567,725	2,857,943	0.535	0.948
20	3,004,369	2,732,404	3,074,888	2,681,166	0.000	1.176
21	2,477,001	9,472,173	2,845,349	8,621,027	0.000	19.540
22	6,244,849	9,158,497	6,878,931	7,641,087	0.000	34.835
23	4,273,399	4,697,957	4,331,906	4,393,078	0.000	6.999
24	5,741,959	2,340,043	4,842,207	2,060,025	20.655	6.428
25	5,991,724	3,307,589	4,994,395	2,608,639	22.896	16.046
26	2,877,350	3,889,221	2,776,029	3,396,172	2.326	11.319
27	2,140,769	4,518,501	2,043,054	3,495,589	2.243	23.483
28	4,502,467	5,486,698	3,876,386	5,361,392	14.373	2.877
29	3,998,636	4,837,310	4,429,882	4,782,710	0.000	1.253
30	7,300,421	2,607,695	7,182,678	2,770,690	2.703	0.000
31	5,892,463	7,887,682	5,770,966	7,543,478	2.789	7.902
32	3,849,202	4,924,331	4,463,175	6,058,428	0.000	0.000
33	8,568,220	13,510,119	8,920,237	13,039,337	0.000	10.808
34	4,252,024	7,893,860	4,228,640	7,858,543	0.537	0.811
35	6,137,858	16,864,632	6,245,579	15,666,094	0.000	27.515
36	14,290,134	5,177,905	13,729,334	5,126,921	12.874	1.170
37	11,961,224	4,965,296	10,616,150	5,379,134	30.879	0.000
38	10,555,083	3,978,954	10,305,491	3,972,557	5.730	0.147
39	6,925,802	586,909	6,325,412	596,575	13.783	0.000
40	842,949	2,258,853	748,631	2,508,255	2.165	0.000
41	9,482,998	5,780,447	8,895,801	6,288,067	13.480	0.000

Table 16. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE
Change in Corrected Bankline Areas Between 1995 and 1997 Aerial Photography (1).

Segment No.	1995 Corrected Bankline Areas (sq. ft.)		1997 Corrected Bankline Areas (sq. ft.)		(2) Change Between 1995 and 1997 Bankline Areas (AC)	
	Left	Right	Left	Right	Left	Right
42	4,022,117	7,965,023	3,884,124	7,928,297	3.168	0.843
43	3,081,531	4,601,941	2,945,728	4,625,074	3.118	0.000
44	9,389,899	11,072,910	9,376,412	10,851,932	0.310	5.073
45	12,244,134	5,262,600	11,928,253	5,167,557	7.252	2.182
46	6,783,634	3,593,918	6,582,592	3,399,482	4.615	4.464
47	1,575,631	10,404,532	1,615,883	9,489,585	0.000	21.004
48	5,846,915	3,867,414	5,828,123	4,135,979	0.431	0.000
49	4,227,375	3,232,041	4,217,151	2,984,087	0.235	5.692
50	4,533,463	2,522,380	4,545,327	2,402,250	0.000	2.758

(1) Net increase in acres are shown as no change in bankline areas.

(2) Change in Acres = $\frac{\text{Change in Square Feet}}{43560}$

Table 17. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE River Mile Locations for Segment Cross-Sections and Approximate Bankline Lengths Subject to Direct Erosion

Segment No.	1960 River Mile Location Upstream X-Section	Downstream X-Section	Bankline Lengths (miles)
1	806.45	805.24	1.21
2	805.24	803.88	1.36
3	803.88	802.75	1.13
4	802.75	801.39	1.36
5	801.39	800.07	1.32
6	800.07	799.30	0.77
7	799.30	798.44	0.86
8	798.44	797.42	1.02
9	797.42	796.36	1.06
10	796.36	794.70	1.66
11	794.70	793.29	1.41
12	793.29	791.91	1.38
13	791.91	791.00	0.91
14	791.00	789.82	1.18
15	789.82	787.77	2.05
16	787.77	787.04	0.73
17	787.04	786.31	0.73
18	786.31	785.16	1.15
19	785.16	784.19	0.97
20	784.19	782.94	1.25
21	782.94	781.68	1.26
22	781.68	780.06	1.62
23	780.06	779.24	0.82
24	779.24	778.67	0.57
25	778.67	777.85	0.82
26	777.85	777.38	0.47
27	777.38	776.41	0.97
28	776.41	775.46	0.95
29	775.46	774.60	0.86
30	774.60	773.77	0.83
31	773.77	772.80	0.97
32	772.80	771.80	1.00
33	771.80	770.70	1.10
34	770.70	769.83	0.87
35	769.83	768.92	0.91
36	768.92	767.18	1.74
37	767.18	765.69	1.49
38	765.69	764.79	0.90
39	764.79	764.06	0.73
40	764.06	763.43	0.63
41	763.43	762.25	1.18
42	762.25	761.09	1.16
43	761.09	760.44	0.65
44	760.44	759.08	1.36

Table 17. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE River Mile Locations for Segment Cross-Sections and Approximate Bankline Lengths Subject to Direct Erosion

Segment No.	1960 River Mile Location Upstream X-Section	Downstream X-Section	Bankline Lengths (miles)
45	759.08	757.40	1.68
46	757.40	756.39	1.01
47	756.39	755.59	0.80
48	755.59	754.42	1.17
49	754.42	753.48	0.94
50	753.48	752.29	1.19

Table 18. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE
Estimated Left Bank Erosion Rates by Segment Number for the 10 Year Period
August 1985 to August 1995

	LEFT BANK			
			(1) Annual Erosion Rates	
			10.0 Years	
Segment No.	Approximate Bankline Length (miles)	Total Acres Lost	Per Segment (Ac/yr)	Per Mile of Bank (Ac/mi/yr)
1	1.21	5.716	0.572	0.472
2	1.36	0.000	0.000	0.000
3	1.13	18.003	1.800	1.593
4	1.36	0.000	0.000	0.000
5	1.32	13.205	1.321	1.000
6	0.77	5.850	0.585	0.760
7	0.86	4.296	0.430	0.500
8	1.02	0.000	0.000	0.000
9	1.06	0.000	0.000	0.000
10	1.66	0.000	0.000	0.000
11	1.41	29.784	2.978	2.112
12	1.38	16.314	1.631	1.182
13	0.91	5.508	0.551	0.605
14	1.18	0.000	0.000	0.000
15	2.05	0.922	0.092	0.045
16	0.73	0.000	0.000	0.000
17	0.73	2.951	0.295	0.404
18	1.15	3.011	0.301	0.262
19	0.97	2.007	0.201	0.207
20	1.25	0.000	0.000	0.000
21	1.26	2.426	0.243	0.193
22	1.62	17.741	1.774	1.095
23	0.82	0.296	0.030	0.036
24	0.57	2.162	0.216	0.379
25	0.82	12.500	1.250	1.524
26	0.47	0.000	0.000	0.000
27	0.97	2.675	0.268	0.276
28	0.95	15.531	1.553	1.635
29	0.86	10.054	1.005	1.169
30	0.83	1.065	0.107	0.128
31	0.97	3.261	0.326	0.336
32	1.00	16.503	1.650	1.650
33	1.10	9.587	0.959	0.872
34	0.87	0.687	0.069	0.079
35	0.91	7.765	0.777	0.853
36	1.74	0.000	0.000	0.000
37	1.49	29.054	2.905	1.950
38	0.90	7.059	0.706	0.784
39	0.73	0.000	0.000	0.000
40	0.63	0.975	0.098	0.155
41	1.18	0.000	0.000	0.000
42	1.16	0.000	0.000	0.000

Table 18. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE
Estimated Left Bank Erosion Rates by Segment Number for the 10 Year Period
August 1985 to August 1995

	LEFT BANK			
			(1) Annual Erosion Rates 10.0 Years	
Segment No.	Approximate Bankline Length (miles)	Total Acres Lost	Per Segment (Ac/yr)	Per Mile of Bank (Ac/mi/yr)
43	0.65	0.000	0.000	0.000
44	1.36	4.025	0.403	0.296
45	1.68	0.000	0.000	0.000
46	1.01	0.000	0.000	0.000
47	0.80	3.965	0.397	0.496
48	1.17	3.411	0.341	0.292
49	0.94	0.000	0.000	0.000
50	1.19	0.668	0.067	0.056
TOTAL	54.16	258.98	25.90 **	0.478 ***

** Average annual erosion rate for the entire reach.

*** Average annual erosion rate per mile.

(1) Erosion Rates $\text{Ac/yr} = \frac{\text{Total Acres Lost}}{\text{10.0 Years}}$

$$\text{Ac/yr/mi} = \frac{\text{Total Acres Lost}}{(\text{10.0 Years})\ (\text{Bankline Length in Miles})}$$

Table 19. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE
Estimated Right Bank Erosion Rates by Segment Number for the 10Year Period
August 1985 to August 1995

	RIGHT BANK			
			(1) Annual Erosion Rates 10.0 Years	
Segment No.	Approximate Bankline Length (miles)	Total Acres Lost	Per Segment (Ac/yr)	Per Mile of Bank (Ac/mi/yr)
1	1.21	0.000	0.000	0.000
2	1.36	3.406	0.341	0.250
3	1.13	0.000	0.000	0.000
4	1.36	0.000	0.000	0.000
5	1.32	0.000	0.000	0.000
6	0.77	0.000	0.000	0.000
7	0.86	0.000	0.000	0.000
8	1.02	0.161	0.016	0.016
9	1.06	7.644	0.764	0.721
10	1.66	7.760	0.776	0.467
11	1.41	0.000	0.000	0.000
12	1.38	0.000	0.000	0.000
13	0.91	7.492	0.749	0.823
14	1.18	4.506	0.451	0.382
15	2.05	0.000	0.000	0.000
16	0.73	0.000	0.000	0.000
17	0.73	0.972	0.097	0.133
18	1.15	5.359	0.536	0.466
19	0.97	0.000	0.000	0.000
20	1.25	0.000	0.000	0.000
21	1.26	0.761	0.076	0.060
22	1.62	2.193	0.219	0.135
23	0.82	39.676	3.968	4.839
24	0.57	7.629	0.763	1.338
25	0.82	0.000	0.000	0.000
26	0.47	0.000	0.000	0.000
27	0.97	0.000	0.000	0.000
28	0.95	0.000	0.000	0.000
29	0.86	3.454	0.345	0.402
30	0.83	15.536	1.554	1.872
31	0.97	34.165	3.417	3.522
32	1.00	10.017	1.002	1.002
33	1.10	1.189	0.119	0.108
34	0.87	12.173	1.217	1.399
35	0.91	36.461	3.646	4.007
36	1.74	3.368	0.337	0.194
37	1.49	6.990	0.699	0.469
38	0.90	5.320	0.532	0.591
39	0.73	10.941	1.094	1.499
40	0.63	8.725	0.873	1.385
41	1.18	16.288	1.629	1.380
42	1.16	6.729	0.673	0.580

Table 19. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE
Estimated Right Bank Erosion Rates by Segment Number for the 10Year Period
August 1985 to August 1995

	RIGHT BANK			
			(1) Annual Erosion Rates	
			10.0 Years	
Segment No.	Approximate Bankline Length (miles)	Total Acres Lost	Per Segment (Ac/yr)	Per Mile of Bank (Ac/mi/yr)
43	0.65	1.748	0.175	0.269
44	1.36	0.000	0.000	0.000
45	1.68	5.858	0.586	0.349
46	1.01	23.564	2.356	2.333
47	0.80	0.000	0.000	0.000
48	1.17	3.397	0.340	0.290
49	0.94	7.454	0.745	0.793
50	1.19	0.000	0.000	0.000
TOTAL	54.16	300.94	30.09 **	0.556 ***

** Average annual erosion rate for the entire reach.

*** Average annual erosion rate per mile.

(1) Erosion Rates $\text{Ac/yr} = \frac{\text{Total Acres Lost}}{\text{10.0 Years}}$

$$\text{Ac/yr/mi} = \frac{\text{Total Acres Lost}}{(\text{10.0 Years})\ (\text{Bankline Length in Miles})}$$

Table 20. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE
Estimated Left Bank Erosion Rates by Segment Number for the 2 Year Period
August 1995 to August 1997

	LEFT BANK				
				(1) Annual Erosion Rates	
				2.0 Years	
Segment No.	Approximate Bankline Length (miles)	Total Acres Lost	Per Segment (Ac/yr)	Per Mile of Bank (Ac/mi/yr)
1	1.21	0.000	0.000	0.000
2	1.36	9.522	4.761	3.501
3	1.13	0.000	0.000	0.000
4	1.36	0.000	0.000	0.000
5	1.32	0.000	0.000	0.000
6	0.77	0.000	0.000	0.000
7	0.86	0.000	0.000	0.000
8	1.02	4.273	2.137	2.095
9	1.06	5.644	2.822	2.662
10	1.66	8.049	4.025	2.424
11	1.41	5.857	2.929	2.077
12	1.38	0.000	0.000	0.000
13	0.91	0.000	0.000	0.000
14	1.18	6.320	3.160	2.678
15	2.05	10.288	5.144	2.509
16	0.73	1.623	0.812	1.112
17	0.73	0.000	0.000	0.000
18	1.15	0.000	0.000	0.000
19	0.97	0.535	0.268	0.276
20	1.25	0.000	0.000	0.000
21	1.26	0.000	0.000	0.000
22	1.62	0.000	0.000	0.000
23	0.82	0.000	0.000	0.000
24	0.57	20.655	10.328	18.118
25	0.82	22.896	11.448	13.961
26	0.47	2.326	1.163	2.474
27	0.97	2.243	1.122	1.156
28	0.95	14.373	7.187	7.565
29	0.86	0.000	0.000	0.000
30	0.83	2.703	1.352	1.628
31	0.97	2.789	1.395	1.438
32	1.00	0.000	0.000	0.000
33	1.10	0.000	0.000	0.000
34	0.87	0.537	0.269	0.309
35	0.91	0.000	0.000	0.000
36	1.74	12.874	6.437	3.699
37	1.49	30.879	15.440	10.362
38	0.90	5.730	2.865	3.183
39	0.73	13.783	6.892	9.440
40	0.63	2.165	1.083	1.718
41	1.18	13.480	6.740	5.712
42	1.16	3.168	1.584	1.366

Table 20. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE
Estimated Left Bank Erosion Rates by Segment Number for the 2 Year Period
August 1995 to August 1997

		LEFT BANK		
			(1) Annual Erosion Rates 2.0 Years	
Segment No.	Approximate Bankline Length (miles)	Total Acres Lost	Per Segment (Ac/yr)	Per Mile of Bank (Ac/mi/yr)
43	0.65	3.118	1.559	2.398
44	1.36	0.310	0.155	0.114
45	1.68	7.252	3.626	2.158
46	1.01	4.615	2.308	2.285
47	0.80	0.000	0.000	0.000
48	1.17	0.431	0.216	0.184
49	0.94	0.235	0.118	0.125
50	1.19	0.000	0.000	0.000
TOTAL	54.16	218.67	109.34 **	2.019 ***

** Average annual erosion rate for the entire reach.

*** Average annual erosion rate per mile.

(1) Erosion Rates $\text{Ac/yr} = \frac{\text{Total Acres Lost}}{\text{2.0 Years}}$

$$\text{Ac/yr/mi} = \frac{\text{Total Acres Lost}}{\text{(2.0 Years) (Bankline Length in Miles)}}$$

Table 21. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE
Estimated Right Bank Erosion Rates by Segment Number for the 2 Year Period
August 1995 to August 1997

	RIGHT BANK			
			(1) Annual Erosion Rates	
			2.0 Years	
Segment No.	Approximate Bankline Length (miles)	Total Acres Lost	Per Segment (Ac/yr)	Per Mile of Bank (Ac/mi/yr)
1	1.21	0.000	0.000	0.000
2	1.36	3.003	1.502	1.104
3	1.13	29.602	14.801	13.098
4	1.36	25.993	12.997	9.556
5	1.32	5.680	2.840	2.152
6	0.77	2.801	1.401	1.819
7	0.86	9.434	4.717	5.485
8	1.02	8.620	4.310	4.225
9	1.06	4.171	2.086	1.967
10	1.66	0.145	0.073	0.044
11	1.41	1.157	0.579	0.410
12	1.38	1.655	0.828	0.600
13	0.91	0.000	0.000	0.000
14	1.18	0.000	0.000	0.000
15	2.05	1.363	0.682	0.332
16	0.73	7.190	3.595	4.925
17	0.73	9.567	4.784	6.553
18	1.15	5.060	2.530	2.200
19	0.97	0.948	0.474	0.489
20	1.25	1.176	0.588	0.470
21	1.26	19.540	9.770	7.754
22	1.62	34.835	17.418	10.752
23	0.82	6.999	3.500	4.268
24	0.57	6.428	3.214	5.639
25	0.82	16.046	8.023	9.784
26	0.47	11.319	5.660	12.041
27	0.97	23.483	11.742	12.105
28	0.95	2.877	1.439	1.514
29	0.86	1.253	0.627	0.728
30	0.83	0.000	0.000	0.000
31	0.97	7.902	3.951	4.073
32	1.00	0.000	0.000	0.000
33	1.10	10.808	5.404	4.913
34	0.87	0.811	0.406	0.466
35	0.91	27.515	13.758	15.118
36	1.74	1.170	0.585	0.336
37	1.49	0.000	0.000	0.000
38	0.90	0.147	0.074	0.082
39	0.73	0.000	0.000	0.000
40	0.63	0.000	0.000	0.000
41	1.18	0.000	0.000	0.000
42	1.16	0.843	0.422	0.363

Table 21. Missouri River Streambank Assessment Gavins Point Dam to Ponca, NE
Estimated Right Bank Erosion Rates by Segment Number for the 2 Year Period
August 1995 to August 1997

RIGHT BANK			(1) Annual Erosion Rates 2.0 Years	
Segment No.	Approximate Bankline Length (miles)	Total Acres Lost	Per Segment (Ac/yr)	Per Mile of Bank (Ac/mi/yr)
43	0.65	0.000	0.000	0.000
44	1.36	5.073	2.537	1.865
45	1.68	2.182	1.091	0.649
46	1.01	4.464	2.232	2.210
47	0.80	21.004	10.502	13.128
48	1.17	0.000	0.000	0.000
49	0.94	5.692	2.846	3.028
50	1.19	2.758	1.379	1.159
TOTAL	54.16	330.71	165.36 **	3.053 ***

** Average annual erosion rate for the entire reach.

*** Average annual erosion rate per mile.

(1) Erosion Rates $\text{Ac/yr} = \frac{\text{Total Acres Lost}}{\text{2.0 Years}}$

$$\text{Ac/yr/mi} = \frac{\text{Total Acres Lost}}{\text{(2.0 Years) (Bankline Length in Miles)}}$$